ARCHITECTURE AND UNDECIDABILITY

Explorations in there being no right answer—Some intersections between epistemology, ethics and designing architecture, understood in terms of second-order cybernetics and radical constructivism

Richard Ben Sweeting

UCL

Thesis submitted for PhD

I, Richard Ben Sweeting confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm this has been indicated in the thesis.

Abstract

In this thesis I have explored some of the ways in which the contexts of epistemology, ethics and designing architecture are each concerned with undecidable questions (that is, with those questions that have no right answers). Drawing on design research, second-order cybernetics and radical constructivism, I have understood this undecidability to follow in each case from our being part of the situation in which we are acting. This idea is primarily epistemological (being part of the world we observe, we cannot verify the relationship between our understanding and the world beyond our experience as it is impossible to observe the latter) but can also be interpreted spatially and ethically. From this starting point I have developed connections between questions in architecture, epistemology and ethics in two parallel investigations.

In the first, I have proposed a connection between design and ethics where design is understood as an activity in which ethical questioning is implicit. Rather than the usual application of ethical theory to practice, I have instead proposed that design can inform ethical thinking, both in the context of designing architecture and also more generally, through (1) the ways designers approach what Rittel (1972) called “wicked problems” (which, I argue, have the same structure as ethical dilemmas) and (2) the implicit consideration of others in design’s core methodology.

In parallel to this I have explored the spatial sense of the idea that we are part of the world through a series of design investigations comprising projects set in everyday situations and other speculative drawings. Through these I have proposed reformulating the architectural theme of place, which is usually associated with phenomenology, in constructivist terms as the spatiality of observing our own observing and so as where the self-reference of epistemology (that we cannot experience the world beyond our experience) becomes manifest.

Preface

I have always been interested in the possible relations between architecture, epistemology and ethics. There is a sense in which ethics and epistemology are relevant to all our acting, including designing, as every action we take concerns questions about our conduct and about how we know about the world. Designing architecture, however, seems especially related to epistemological and ethical ideas. The activity of designing can be understood as being an epistemological activity rather than just as involving epistemology (as Cross (1982) has put it, there are distinctively "designerly ways of knowing") while designing architecture inevitably involves ethical issues (especially in the sense that architecture embodies an ethos (Harries, 1975, 1987, 1997) as well as whatever specific ethical questions it raises).

I have sometimes thought of the relationship between epistemology, ethics and architecture as a linear one in terms of various ways of applying theoretical ideas to design, such as, for instance, communicating such ideas through architecture or having them guide design practice. During the course of this thesis I have come to understand the activity of designing as coinciding with epistemological and ethical questions rather than as following from them. What connects these topics together, as I see it, is that they are all concerned with undecidable questions—that is, with the sorts of questions which do not have definite answers for us to conform or correspond to. This undecidability can be traced in each case to our involvement as part of the situation in which we are acting, an idea which I have taken as the main point of departure for my work.

Acknowledgements

I am enormously grateful to my supervisors, Neil Spiller and Ranulph Glanville, for their generous support, encouragement and advice. I could not have come close to completing this thesis without their insightful comments and engagement with my research. I also owe a huge debt of gratitude to my examiners, Ted Krueger and Peg Rawes, for their questions and comments during the viva examination which have helped me both to finalise this thesis and also to formulate new research questions.

I would like to thank the AHRC for supporting me with funding throughout my research and the Bartlett's Architecture Research Fund, the UCL Graduate School Research Projects Fund and the University of Brighton for financing particular elements of work.

I am deeply thankful for the help I've received from everyone who has let me talk my ideas through with them and for the patience of all my friends and colleagues. In particular I would like to thank: Mike Aling, Wes Aelbrecht, Alex Arestis, Tilo Amhoff, Lenastina Andersson, Alessandro Ayuso, Katherine Bash, Nicholas Beech, Philip Beesley, Alicja Borkowska, Annabel Brown, Matthew Butcher, Nat Chard, Becky Charles, Tony Charles, Kate Cheyne, Mel Clinch, Kate Cronk, Jim Curtis, Ines Dantas, Tom Foulsham, Susannah Hagan, Penelope Haralambidou, Kieran Hawkins, Jonathan Hill, Claire Hoskins, Popi Iacovou, Ersi Ioannidou, Sara Kane-Little, Thomas-Bernard Kenniff, Christian Kerrigan, Elisa Lega, Glenn Longden-Thurgood, Yat Ming Loo, Pete Marsh, Robert Massey, Catalina Mejia, Tim Norman, Kathleen O'Donnell, Megan O'Shea, Barbara Penner, Permanent Waver, Andrew Porter, Caroline Rabourdin, Charlotte Raleigh, RARA (Redundant Architects Recreation Association), Tony Roberts, Uwe Schmidt-Hess, Markus Seifermann, Bob and Vicky Souster, Catrina Stewart, Alex Warnock-Smith, Phil Watson, Michael Wihart, Claudia Westermann, Owain Williams (both of you) and Ivana Wingham.

Contents

Figures

Examples of sketching

The contingencies of objects

Examples of indexical situations

Allotment Calendar

Toast Rack

Staircase Clock

St. Alphage Gardens

Café Bohemia

Hackney Churchyard

Case study: Light Well by Permanent Waver

Epistemological Theatre, study (1): Hatching

Epistemological Theatre, study (2): Disalignment

Image sources

All figures are drawings and photographs by the author, except the following:

Figure 17: taken from http://commons.wikimedia.org/wiki/File:A_Sea_Of_Steps_--_Wells_Cathedral_LACMA_M.2008.40.736_(1_of_3).jpg (Frederick H. Evans)

Figure 18: taken from http://commons.wikimedia.org/wiki/File:Wells_Cathedral,_Chapter_House_Steps_-_geograph.org.uk_-_352935.jpg (Alan Longbottom)

Figure 19: taken from http://commons.wikimedia.org/wiki/File:Pigna_-_porticus_minucia_1180700.JPG (Lalupa)

Figure 46 and Figure 47: Photographs provided by Sara Kane-Little and Matthew Bowyer

Figure 109 and Figure 110: Photographs by Tim Norman. Light Well is a work by Permanent Waver (Tim Norman, Pernilla Ohrstedt and Matthew Wilkinson).

OS Data used for site context and location plans sourced from Digimap.

Word count and reference style

Main body of text: 64,500 words.

Total including bibliography, footnotes, captions, tables of contents, list of figures, abstract, preface and acknowledgements: 90,660 words.

References have been formatted in accordance with the 6th edition of the Publication Manual of the American Psychological Association.

PART I—Beginnings

1.1 Introduction

I have divided Part I into three sections. In this, the first, I introduce the main themes of my research, my principle sources and methods and the overall structure of the thesis. In the two sections which follow (1.2, 1.3), I present my two main points of departure: firstly, an account of epistemology and ethics in terms of cybernetics and radical constructivism; secondly, a spatial investigation of the contingencies of design decisions, pursued through a series of drawings.

1.1.1 Themes

In this section I introduce the three main themes of my thesis: firstly, those situations (in epistemology, ethics and design) which have no right answer; secondly, the epistemological, ethical and spatial senses in which we are part of the world; and, thirdly, the relation between architecture, epistemology and ethics in which context the first two themes sit.

1.1.1.1 No right answers

In this thesis I have explored some characteristics of situations where there is no right answer—that is, those which are "wicked" (Rittel, 1972; Rittel & Webber, 1973), "undecidable" (von Foerster, 1991, 1990/2003) or otherwise contestable, irresolvable or arbitrary. I have approached this in three different contexts—that of designing architecture, that of epistemology (that is, the philosophy of knowledge or, as von Glasersfeld (1990a, p. 19) puts it, of knowing) and that of ethics (that is, in terms of questions about our action or conduct and our deliberation, in both personal and philosophical senses, over that conduct).[1] While these different fields raise diverse questions, I see them as being related such that they can inform each other.

[1] "Ethics" and "ethical" are terms which can be used in many different ways and which can therefore become confusing. In the context of architecture, speaking about ethics can sometimes come across as being worthy or even judgemental. This is not the sense in which I mean it. Part of the confusion is the way that we can use these terms to refer

By describing some situations or questions as having in principle no right answer I do not mean to imply a position equivalent to nihilism, solipsism or relativism (that ethics, epistemology or design are entirely arbitrary) but, rather, to explore the idea that in each of these three different contexts it is misleading to consider our action (our designing, our knowing, our conduct) in terms of a relation or correspondence to some final answer (an ideal solution, a true fact, a moral code). That is, I mean to explore the ideas that: (1) knowledge is not a correspondence between our understanding and the world beyond it; (2) ethical conduct is, similarly, not a matter of conforming to an ideal way of acting; and (3) that the activity of designing cannot be successfully codified into objective rules or rule governed processes.[2] While it is possible to take a contrary position in each case, to do so, as I see it, is to leave something of importance—our own involvement in the situation—behind.

---

both to our personal conduct and also to deliberating about that conduct. When we refer to the ethics of our actions we can sometimes mean the values which our actions embody or the principles which we try to uphold in them (this is sometimes referred to as morality but I have used this term to make a different distinction, following von Foerster (1991, 1990/2003), see below). When we say that an action is ethical in this sense we mean that we judge that it is good or right in the sense that it conforms to whichever values or principles we choose to judge or justify it with. In this sense, by an "ethical action" we mean a "good action". It is not with questions of this order, of what comprises a good action in a situation or with what standards or criteria are to be invoked to make this judgement, that I am interested here. A different sense of "ethics" refers to the activity of making such judgements and to the question of how to go about doing so. This can be meant in both a philosophical and a personal sense (and these two coincide to some extent because adopting any philosophically derived principle can only be done personally). When we call an action "ethical" in this sense, we mean that it is an action which involves ethical considerations (that is, in the sense of ethical philosophy or ethical questions) rather than that we judge it as being in accordance with some principle or value (such as, in comparison, an ethically good way of doing philosophy or of asking a question). It is in this sense of actions which involve ethical questioning, rather than in the sense of what may or may not be a good answer to such questions, with which I am concerned. This is how I have generally used the term below. Where for instance I say that the epistemology of cybernetics is implicitly ethical I do not mean that the practice of it is accords to some set of values but that it involves ethical questioning. Where I need to refer to the other sense I have signposted this either by referring to moral codes and calculi (standards about what is good) or saying "ethically good".

[2] For instance, that designing architecture cannot be optimised or otherwise automated as a whole without this being arbitrary; see below section 2.1.2.

By focusing on undecidability I do not mean to imply indecision; on the contrary, as von Foerster (1990/2003, p. 293) notes, it is undecidable decisions rather than decidable ones that we must decide.[3] Neither does it follow that my presentation need be ambiguous (the ambiguity of undecidability is something that it is possible to be precise about) nor that chance and indeterminacy should necessarily be emphasised as architectural or designerly strategies—although this is one possible response and one which I have adopted in some respects.[4]

My starting point in exploring this topic is in terms of epistemology from which I have made connections to ethics, design and architecture. The question of whether epistemological questions have right answers rests on the acceptance or otherwise of realism (the idea that our experience of the world is one that corresponds to how the world is beyond this experience). The epistemological understanding that I advocate here in contrast to realism is that shared by the closely associated positions of radical constructivism and second-order cybernetics.[5] Radical constructivism is not so much an epistemological position but rather a critique of the traditional understanding of epistemology in terms of a correspondence between our understanding and the world beyond our experience. Such a correspondence is impossible in principle to verify as we cannot do so except on the basis of further observation.[6] This does not entail that our understanding is solipsistic or that we

---

[3] For Derrida, similarly, the undecidable does not imply indecisiveness but decision (Hill, 2007, pp. 110-111).

[4] In terms of approaching architecture in terms of indeterminacy see for instance Chard (2005), Havik, Patteeuw and Teerds (2011) and Manolopoulou (2006, 2011).

[5] On second-order cybernetics and radical constructivism, and the relation between the two, see for instance Glanville (2002b, 2013), Müller (2008, 2011), Scott (2004, 2011), von Foerster (1974/1995, 1979/2003, 1974/2003, 1973/2003) and von Glasersfeld (1974, 1981, 1984, 1990a, 1991, 1992, 1996). The term "radical constructivism" was coined by von Glasersfeld (1974) but refers to a position already anticipated in his earlier work as well as in that of Ceccato (with whom he worked), Piaget, Vico and Berkeley whose accounts he builds on (see for instance von Glasersfeld, 2007). In drawing on second-order cybernetics and radical constructivism I have referred largely to Bateson, Glanville, Pask, von Foerster and von Glasersfeld. Cybernetics is a small field and there are few who work primarily with and within second-order cybernetics. While it follows that the range of relevant sources is relatively few, this does not mean that their value is reduced.

[6] This argument, as von Glasersfeld (1984, p. 6; 1990a, p. 20) points out, dates back as far as sceptics such as Pyrrho, Sextus Empiricus and Xenophanes.

commit to any other anti-realist position as these can no more be verified than realism. Rather, it is to understand our understanding as being of our experience rather than of the world beyond it.

Many of the questions which we encounter in the context of ethics are ones where there is no clear right answer. Indeed, it is when faced with such dilemmas that we turn to ethics for guidance. Many ethical theories or principles claim to give us definite guidance in such situations, providing us with moral codes to follow or with particular priorities to maintain above all others. These however sometimes conflict with each other, such that different imperatives follow depending on how we frame the question or to which theory we turn, having the effect of elevating the decision to one between competing principles (see for instance the examples given by MacIntyre, 1981/1985, pp. 6-10). Whether this is a consequence of values necessarily conflicting with each other as a matter of principle (Berlin, 1964/1998, 1988/1998, 1958/1998) or a deficiency of our contemporary understanding of ethics (Anscombe, 1958; MacIntyre, 1981/1985) is uncertain.[7] In either case it follows that in these situations one cannot claim one's own ethical understanding to have objective force. In resolving such questions we become part of them and so ultimately responsible, such that even those principles which make objective claims of us can only have binding force where we choose to allow them to.[8] As with constructivist epistemology, this does not necessarily entail relativism (that ethical judgements are personal or social) or anti-realism (such as for instance ethical nihilism, that nothing is ethically preferable to anything else) but rather recognition that the questions of whether ethical propositions are objective or universal cannot in principle be settled because we cannot remove ourselves from them. While most obviously this means that we cannot objectively claim objectivity, it is equally the case that we cannot be certain of relativism or nihilism. In all cases we are ultimately responsible for our own understanding.

---

[7] While MacIntyre argues that this quality of contemporary ethical debate results from our mistaken conception of ethics, what he proposes instead, a neo-Aristotelian virtue ethics, does not necessarily solve such dilemmas and indeed can be criticised for the lack of guidance it provides (for instance by Louden, 1984/1997, pp. 205-206). For MacIntyre there still remain unresolvable dilemmas but these are understood as being unresolvable in practice rather than incommensurable in principle (see MacIntyre, 1981/1985, pp. 224-225).

[8] This argument is advocated in existentialism by for instance Sartre (1946/1948, p. 36) and Tillich (1956, p. 86).

The positions I have outlined above differ entirely from conventional assumptions about epistemology (that knowledge is a true correspondence with the world) and ethics (as differentiating between right and wrong conduct). The claim that there is no right answer applies equally to itself in that one cannot insist that this is a true account.[9] By disputing epistemology and ethics in this way we are left with the problem of how to act given that we are uncertain of what is the case and of what is best. By contrast, in designing architecture, that there is not some ideal or optimal solution to be found is a familiar idea. Such theories as that suggested otherwise—most notably functionalism and its equivalents in design theory—have been widely discredited.[10] While the absence of a right answer is nevertheless sometimes framed as being problematic (as for instance by Rittel, 1972), this argument can be reversed so that design is understood as demonstrating expertise with ill-defined and complex situations (Cross, 1982, 2007a; Gedenryd, 1998; Glanville, 2007c, 2011).[11]

Design's expertise in terms of situations that have no right answer is of relevance to both epistemology and ethics. Designers deal as a matter of course with complex epistemological and ethical questions and in so doing demonstrate an unproblematic way of acting in apparently problematic circumstances. The connection between epistemology, understood in terms of constructivism and cybernetics, and design is a substantial one to the extent that we can understand design as practising such an epistemology or even as being analogous to it (Cross, 1982, 2007a; Dubberly & Pangaro, 2007; Gedenryd, 1998; Glanville, 2006a, 2006b, 2007e, 2009b; Jonas, 2007b; Krippendorff, 2007a; Pangaro, 2008; Schön, 1983/1991). Therefore, as well as the theory of design drawing on constructivism to understand designers' particular ways of knowing, design can also

---

[9] See for instance the insistence by von Glasersfeld (1984, p. 14; 1990a, p. 19) that radical constructivism cannot itself claim to be a true account of knowledge and by von Foerster (1990/2003) that whether or not we are part of the world is undecidable in principle.

[10] One could however also add what Harries (1997, p. 228) notes as the perennial tendency towards Platonism in architecture and the resurgence of technological determinism that has followed recent developments in design software.

[11] It is significant that this expertise is not about resolving such situations, in the sense of problem solving, but of acting in them. See discussion of wicked problems below (section 2.1.1).

contribute to how we understand epistemology. In particular design demonstrates how a constructivist epistemology, despite (or indeed because of) its implicit uncertainty, can be effective in complex situations.

While the connection between design and epistemology is direct and has been widely explored in design research, the relationship between design and ethics is more complex. Ethics and design are most conspicuously related where explicit ethical questions are raised by design projects (such as sustainability, technology, professional ethics or the relation between designers and those they design for) which can be resolved or clarified by reference to ethical debates and theories (that is, as a form of applied ethics).[12] This application of ethics to design in order to resolve or clarify specific ethical questions is not what I am concerned with in this thesis. Rather than applying ethical theory to design practice in this way, I am interested in the overlap between the activities of ethical questioning and of designing. There are two reasons to expect this to be a potentially fruitful avenue of investigation. Firstly, as ethics is often concerned with situations where there is no right answer (that is, with ethical dilemmas), the expertise of design with such situations is of relevance, especially given that the situations that designers deal with involve ethical content. Secondly, it has been suggested that, in cybernetics, ethical questions coincide with epistemological questions (von Foerster, 1974/2003, p. 244), although this claim has only been developed relatively tentatively (why this is the case will become clear when discussed more fully below). Given the analogy that can be made between cybernetics and design, I have argued below that ethical questions also coincide with the epistemological questions of designing, in a similar way as with cybernetics. Establishing the connection between design and ethics in this way provides an alternative to seeing their relationship in terms of the application of ethical theory to design and instead understands there to be ethical aspects to design's own disciplinary foundations.

[12] For instance the accounts of D'Anjou (2011), Fox (2006; see also Radford, 2009), Ray (2005) and Spector (2001).

1.1.1.2 Undecidability and being part of the world (spatially, epistemologically, ethically)

One way of describing a question or situation where there is no right answer, in the sense I have described this above, is as it being undecidable (von Foerster, 1991, 1990/2003; von Foerster & Poerksen, 2002, pp. 152-155).[13] In answering a decidable question we will either be right or wrong, there being a correct answer or set of correct answers already implied in the asking of the question. Undecidable decisions by contrast are those that do not have pre-determined answers and which we therefore must answer ourselves. The significance of the decidability of a question is therefore that it locates the nature of our responsibility for the answer we give—whereas with decidable questions we are not responsible for the answer itself but only for giving it, with undecidable questions we are completely responsible for the answer we give and its consequences. To claim that an undecidable decision that we face is decidable (decided for us by logical reasoning or by some authority to which we defer) is to attempt to avoid responsibility for our decision.[14]

I will return in more depth to the qualities of undecidable situations, and our responsibility for them, in later sections. Here I introduce one particular instance of undecidability within the

---

[13] The term undecidable is closely associated with Gödel (1931/2004), who von Foerster references. Gödel showed that even in a carefully constructed mathematical and logical system such as Whitehead and Russell's (1910/1997) *Principia Mathematica*, some propositions would always remain undecidable (see also Hofstadter, 1979/1999; Nagel & Newman, 1958/2005). Undecidability is also an important term for Derrida who uses it in a similar way to von Foerster—also initially referencing Gödel (Derrida, 1972/2004, p. 229) and later Kierkegaard (Derrida, 1992/2008) whose understanding of choice and responsibility is consistent with that of von Foerster (for the relation between Derrida and Gödel and for the relation of this to ethics in Derrida, see Livingston, 2010). While Kierkegaard himself does not use the term undecidable, the theme of radically free choice is featured throughout his writing in for instance the choice between different life stages (Kierkegaard, 1843/1944a, 1843/1944b, 1845/1967) and particularly in his conception of religious faith and the absurd (Kierkegaard, 1844/1962, 1846/1968, 1843/1985).

[14] On the attempt to avoid responsibility through objectivity, see for example Berlin (1964/1998, p. 95), Sartre's notion of bad faith (Cox, 2006, pp. 91-129; Sartre, 1943/1969, pp. 47-70, 625-628), Tillich (1956, p. 86) and von Foerster (1990/2003, p. 293).

context of epistemology, which has been presented by von Foerster (1990/2003) as an undecidable pair of questions:[15]

> "Am I *apart from* the universe?" Meaning whenever I *look*, I'm looking as if through a peephole upon an unfolding universe; or, "Am I *part of* the universe?" Meaning whenever I *act*, I'm changing myself and the universe as well. (p. 293)

In this pair of questions von Foerster summarises the fundamental question of epistemology, that of whether our observation gives us objective descriptions of the world.[16] In presenting this as an undecidable choice, von Foerster gives us one formulation of radical constructivism.[17] These questions cannot be decided in principle because in trying to verify our observation of the world we inevitably encounter the problem that we cannot do so except through our observation, which is what we are trying to test. By choosing to understand oneself as being part of the world one returns again to the undecidability of the question, one's responsibility for one's answer and the possibility of answering differently. The self-reference of these questions leads back to undecidability even if one takes the other choice. Even if one's observation is objective, one can still not verify this independently of it and objectivity therefore rests on an assertion and thus returns us to a decision we are part of. This choice remaining undecidable, it follows that our epistemology is our own responsibility.

Von Foerster (1991, 1990/2003) suggests a connection from this to ethics, arguing that if we are part of our own observations and so cannot claim objective authority, we are therefore ultimately responsible for all our own thinking and acting and are not justified in imposing our own

---

[15] I refer to this as a pair of questions rather than one question with two sub-questions as this is how von Foerster (1990/2003) himself introduces this point: "Objectivity, Pontius Pilate, hierarchies, and other devices are all derivations of a choice between a pair of in principle undecidable questions…" (p. 293).

[16] I have used the phrase "part of the world", following Bröcker (2003), rather than "part of the universe" as von Foerster (1990/2003, p. 293) puts it in the passage I have quoted. These are epistemologically the same point but using "world" rather than "universe" makes it easier to connect this to the spatial sense of the idea which I have suggested.

[17] Von Foerster however distances himself from even this label (von Foerster & Poerksen, 2002, pp. 42-44).

views on others. As well as being connected with ethics, this epistemology is also rooted in a spatial idea. It is because our observation of the world is always from a position located within it, with whatever biases or blind spots this gives us, that our understanding will always be partial and that our observations cannot be separated from us. We cannot in principle perceive the world other than through our bodily spatial experience, an idea which is central both, on the one hand, to pragmatism and empiricism, such as that of Dewey (1905), James (1904) or Piaget (1955), and also, on the other, to the phenomenology of Heidegger (1927/1962) and Merleau-Ponty (1945/1962) for whom our being is a being-in-the-world in the sense of being involved in it.[18] While the notion that we are part of the world in von Foerster and what Heidegger calls our being-in-the-world are developed in very different contexts, the relationship between them is more substantial than just a coincidently similar terminology. Both are concerned with the intricate and inseparable connection between observer and the thing observed (being part of the world; Heidegger's readiness-to-hand) in contrast to the supposedly neutral observation of objects (being apart from the world; Heidegger's presence-at-hand) which is usually given primacy. The notion of being-in-the-world has been significant in the approach to architecture and to architectural theory which is usually referred to, given its sources although perhaps still somewhat confusingly, as phenomenology, such as that of Harries (1997), Norberg-Schulz (1971, 1975, 1980, 1986) and Vesely (2004, 2010), and especially to the architectural theme of place (e.g. Norberg-Schulz, 1980), which is an important reference in much of my design work.[19]

As well as a link to epistemology, there is also a connection between the spatial idea that we are part of the world and ethics in that we share the same space and participate in the same world. Thus one can see our spatial embodiment in the world as being the root of the epistemological idea that we are part of our own observations and both these spatial and

[18] Heidegger's philosophy has sometimes been interpreted in pragmatist terms such as by Dreyfus (1991); this reading has been criticised by Harman (2002, pp. 114-127).

[19] In suggesting the possibility of this connection it is notable that Norberg-Schulz (1965; 1971, pp. 9-12; 1986, pp. 29-31) draws significantly on Piaget (1955; Piaget & Inhelder, 1956) as well as on Heidegger.

epistemological ideas as being of significance for ethics. One way that these three senses of being part of the world (epistemological, ethical and spatial) can be read together is in the work of Bateson (1979/1985, 1972/2000). Bateson's cybernetic account of our being part of the world (although he doesn't use that phrase specifically, which is von Foerster's) is at once epistemological and ethical (understanding us being inseparable from each other and from our environment) and is based on an understanding of the biological (and so spatial) world and also on a spatial metaphor—that of the traditional cosmological idea of the great chain of being (Lovejoy, 1936) which has had a long history of significance in architecture.

1.1.1.3 Architecture, epistemology and ethics

The two themes that I have introduced so far have raised questions of epistemology, ethics and of our presence in the world in relation to design and architecture. These themes therefore sit in the context of the relation between architecture and philosophy (specifically epistemology and ethics) and this relation forms my third theme.[20] While it is possible to think of any action in epistemological and ethical terms, the connections between architecture and ethics, epistemology and other philosophical issues are particularly numerous. This is to be expected given that both architecture and philosophy are disciplines that address our lives and the world in the widest of ways. Architecture raises questions that are, for instance, variously aesthetic, ethical, political and semiotic in nature and, being a constituent part of culture, is a subject of cultural critique. Unlike many other artefacts however, architecture is often not just the expression of a culture but also the attempt to be such an expression (Harries, 1997, p. 285) and it is therefore not just subject to critique but also sometimes a response to such criticism or a form of critique itself. In this sense it can be thought of as an instance of the hermeneutic circle where the act of building responds to and simultaneously reshapes a way of life which in turn reinterprets the architecture in response (Harries, 1997, pp. 147-149).

[20] I should note that I am not a philosopher and that I have approached these questions in terms of the insights of cybernetics and design rather than by using philosophical methods.

The two themes discussed above have already sketched out the epistemological and ethical issues with which I am concerned. In the rest of this section I introduce two points more fully: firstly, that of the ethical questions which are raised in the relation between designers and those they design for; secondly, that of some of the potential relations between epistemology, architecture and communication.

As Harries (1975, 1984, 1987, 1997) has argued, architecture has an ethical function in a different sense to that of the practical ethical questions which it raises, in that it embodies an ethos—that is, a way of living and especially one in which we participate as part of a community. Harries (1987, p. 29; 1997, p. 2), drawing on Giedion's (1941/1982) phrasing of the task of architecture as "the interpretation of a way of life valid for our period" (p. xxxiii), sees architecture as addressing what he regards as the fundamental question of philosophy, that of our place in the world, and the contemporary confusion of architecture as mirroring our deeper uncertainty over this.[21] While Harries' concern with ethos should be differentiated from the applied ethical questions raised in architecture, it does raise specific ethical questions of its own, as noted by Leach (2005) and Till (2009, pp. 171, 184-185). In embodying an ethos, architecture proposes and instigates ways of acting. Sometimes this will be a deliberate invocation of ethics or other potential authorities (such as rationality or the zeitgeist) but even when not, proposing architecture always embodies an ethos to some extent because architecture shapes the conditions within which others will live. While in some times and cultures designers may have been compelled to follow a particular ethos, in our present context there is no settled idea of what such an ethos should be. In this situation the choice of ethos by the designer is the responsibility of the designer, even in the case of a choice to emulate the existing ethos of a community rather than to propose a new one.

---

[21] Harries (1987, p. 29) makes his point with reference to Wittgenstein's (1953/2009) characterisation of philosophical problems as having the form "I don't know my way about" (p. 55). Whereas some questions of this form are superficial in that they occur in the context of established ways of acting (for instance, being lost in a strange city), Harries argues that genuinely philosophical problems are those where we question our place in the world, a theme that is shared with architecture.

We encounter many situations in everyday life which, similarly to designing architecture, have no right answer and which impact on others. Yet while in everyday situations we can usually try to find consensus over such questions, it is not possible to do this in designing architecture.[22] Our decisions impact on the lives of others who we may never meet or know about, let alone consult meaningfully or find agreement with. This is after all the point of architecture (to intervene in the lives of others). Yet there follows an asymmetry, inevitable in the act of making architecture, which tends towards paternalism—that however thoughtful and well-intentioned designers are, they will always be proposing and instigating a way in which others will act.[23] This particular ethical dilemma of designing architecture is an instance of what I refer to below as the ethical question of ethics itself—that is, the ethical question of how one speaks and reasons about ethical questions—with which my account is particularly concerned.

As well as this relation to ethics, architecture also has a number of relations to epistemology. The design process has been widely understood and theorised in epistemological terms as I outline more fully below (see for instance Cross, 2007a; Gedenryd, 1998; Glanville, 2007e; Schön, 1983/1991). As well as the design process, one can also understand how architecture is perceived and understood in terms of epistemology and, by understanding the epistemology of designing architecture in relation to that of observing it, one can consider architecture as a medium of communication. One way in which architecture has traditionally been concerned with communication is by embodying and situating our understandings of the world such as, for instance, in the art of memory (Yates, 1966/1984) or the complex cosmological symbolism of the Baroque (Vesely, 2004, pp. 196-226). While in our contemporary situation it is neither desirable nor possible for architecture to be a repository of understanding in the same sense that it has been traditionally, I am interested in how epistemological ideas might nevertheless find architectural expression in a

[22] That such a consensus would be possible in architecture is, along with a seemingly infinite supply of resources and the enjoyment of work, one of the wonderfully optimistic assumptions in William Morris's (1890/1995) utopian fantasy *News from Nowhere* (see pp. 90-91, 100-101).

[23] This is still the case to some extent even where the architecture is to be completed or interacted with by its users as this transfer of agency is still instigated as a way of others acting.

similarly spatially rich way. In trying to work with epistemology in relation to architecture I have taken the idea that we are part of the world, as introduced above, as my point of departure, interpreting it both as a spatial idea with epistemological consequences (that our embodiment in space leads to the undecidability of epistemology) and also as an epistemological idea with spatial consequences (that we are part of our design decisions which are therefore contingent).

1.1.2 Context

1.1.2.1 Possible sources

It is in the nature of taking situations which have no right answers as a topic that, as well as the aspects of designing architecture which relate to this (such as for instance the various deficiencies of functionalism and the design methods movement; the determinism of various styles; the longstanding architectural theme of machines; ethical questions about participation and agency), there are many other relevant sources which could be referred to. There is a sense in which philosophy is always concerned with finding correct reasoning or true principles, with whether this is possible and, if not, with what consequences follow. Indeed, as Berlin (1988/1998, p. 5; 1958/1998, pp. 237-238) notes, philosophy is often based on the assumption not just that truths can be found but also that once found they will be compatible with each other. It follows that most of what has been written in philosophy could be referred to as addressing this question in one way or another and my treatment of the topic and its context is therefore inevitably partial. In order to keep my account manageable I have largely drawn on sources from second-order cybernetics and radical constructivism and my account is therefore not intended to be an exhaustive one but rather an exploration of this position in particular.

While, below, I have predominantly referred to sources within cybernetics I have also made references to some others where relevant in order to criticise, contextualise and extend this position. One important comparison I have suggested above and which I return to below is that between cybernetics and phenomenology, both in the sense of their relation in terms of epistemology and also, by drawing on those accounts of architecture which refer to phenomenological sources, as a way to suggest a connection between my theoretical concerns and

spatial ideas. In terms of ethics, I have made references to the accounts of Berlin, Eagleton, Kierkegaard, MacIntyre and Sartre and the choice of these requires some explanation as none have a direct connection to cybernetics or to architecture. While the relevance of Berlin, Eagleton and Kierkegaard to my topic is relatively clear (Berlin's pluralist meta-ethics is one version of my starting point of undecidability and he (2000) references Vico in a similar way to von Glasersfeld (2007); the example which I have taken from Eagleton (2007) is implicitly cybernetic (see section 2.2.1 below); Kierkegaard's work is an exploration of undecidable choice amongst other themes), my reasons for referring to Sartre and to MacIntyre are more complex. The connection I see with cybernetics is a common, but quite different, concern with purpose in each case. Sartre's (1946/1948, 1943/1969) position unfolds from the idea that we have no given purpose and that our purpose, and so ethics, is therefore a matter of arbitrary criteria-less choice. MacIntyre's position is in opposition to this (and is specifically critical of it; see 1967; 1981/1985, pp. 23-35, 204-225), in that he understands ethics in terms of purpose, in the Aristotelian sense of being directed towards the goal of *eudaemonia* (the good life, human flourishing), and this purpose as grounded in society and community. Purposeful action is one of the foundational themes of cybernetics (for instance Rosenblueth, Wiener, & Bigelow, 1943) and my reason for referring to the positions of MacIntyre and Sartre is therefore that this is an aspect of debates about ethics to which cybernetic ideas are relevant.

In this section I have only given a brief account of cybernetics, noting particularly some of its connections to aspects of designing architecture which are close to my topic. I have returned to cybernetics and radical constructivism again below in order to introduce them in more depth (section 1.2). My reasons for developing my account in cybernetic terms rather than through many of the other references that would have been possible is that, firstly, cybernetics directly addresses the topic in terms of the inclusion of the observer and that, secondly, it can be applied in each of the three areas of epistemology, ethics and design with which I am concerned and suggests connections between them.[24] Other points of reference could however be advocated in similar terms. In

[24] As Mead (1968, p. 2) notes, it was the original motivation of cybernetics to enable interdisciplinary communication.

particular deconstruction and phenomenology both similarly begin from the inclusion of the observer and have a substantial history of being invoked in architecture.[25] After briefly introducing cybernetics below, I have reviewed the possibility of using these other sources as alternative points of reference in order to contextualise my use of cybernetics and to present my reasons for choosing to work within this field rather than others.

1.1.2.2 Design methods and design research

The idea that in designing architecture there is not one correct design solution is a familiar one. It is most conspicuously associated with the deficiencies of functionalism and the related attempt to scientise design as a logical and objective procedure by the design methods movement (including, for instance, Alexander (1964), Jones (1970) and Simon (1969/1996); see overviews given by Cross (2007a, p. 119-121; 2007b) and Gedenryd (1998)). Such an approach has been widely discredited, both as part of the general reaction against architectural modernism and also from its failure to either describe what designers did or to provide usable methodologies. As Cross (2007b, p. 42) has noted, even its original proponents distanced themselves from it relatively quickly (Alexander, 1971; Jones, 1977).

One influential criticism of this approach is that of Rittel, who distinguished between the tame problems that can be solved via the scientific method and those wicked problems, such as those in design, which are unresolvable by such linear methods because of their complexity and ill-definition (Rittel, 1972; Rittel & Webber, 1973).[26] Such criticisms of the attempt to scientise

[25] Pragmatism could be included here as another possible basis for an approach which takes in epistemology, ethics and design. Cybernetics can however be thought of as a development of, and improvement on, the pragmatist position (see for instance Barnes, 2007; Pickering, 2010).

[26] Many of my sources date from the early and mid 1970s, being associated with the development of second-order cybernetics and the reaction against the design methods movement during this period. While this choice has been partly one of focusing the thesis, there is also a sense that this period is a crucial one for my topic within the context of architecture, coinciding with the development of computing in the context of design and substantial criticisms of modernist functionalism. This period fits into the larger historical context of the split between the subjective and the objective following from the enlightenment, as described in architecture by Vesely (2004) and in ethics by MacIntyre (1981/1985). There is a

design have led to the consideration of the epistemological foundations of design in design's own terms rather than in those imported from science, as advocated by for instance Archer (1979, 1995/2012), Cross (1982, 2001, 2007a), Cross, Naughton and Walker (1981), Glanville (2004a) and Schön (1983/1991). While there is varied terminology for this approach reflecting different agendas and positions[27] as a whole it can be referred to as "design research" as by Cross (2007a, p. 124), Michel (2007) and Grand and Jonas (2012).[28]

1.1.2.3 Architecture and machines

A second relevant current from architectural functionalism is that of the machine, a theme with a history of being invoked in architecture which dates back to Book X of Vitruvius.[29] The modernist invocation of the machine, as for instance by Le Corbusier (1923/1989) or Giedion (1948/1969), is of something that performs a definable task and which is tuned precisely to this purpose. A machine, understood in this sense, embodies the idea of there being an optimisable right answer. This is however only in part a matter of functionality. Its main sense is, rather, about the aesthetic enjoyment of the efficiency, precision, streamlining and definiteness of their forms. Yet machines are not invoked only in this way. The machines of, for instance, Duchamp, Goldberg, Kafka

---

renewed contemporary relevance to this era given the tendencies towards automation in recent developments in design software, such as parametric design and building information modelling.

[27] For instance, the original "design methods" (Broadbent & Ward, 1969; Jones, 1970); Krippendorff's (2006) "science for design" (p. 35) in contrast to the notions of "design science" and "science of design" described by Cross (2007a, pp. 122-123) and the terms research "into", "for" and "through" design introduced by Archer (1995/2012, p. 117) and Frayling (1993).

[28] Although Krippendorff (2007b) argues there is sense in which this phrase, at least in the scientific sense of research, is an oxymoron in that to research something (to re-search) is characteristically to repetitively and systematically search for patterns in existing data, whereas to design is always to offer a conjecture about the future.

[29] Cross (2007a, p. 119) connects the 1920s modernist concern with the machine (understood as the search for scientific design products) with the 1960s design methods movement (the search for a scientific design process) and suggests that this 40 year cycle of concern with the relation between design and science may be returning in the 2000s. Recent developments in the technology of construction and design, notably parametric design and building information modelling, have indeed returned themes of automation to the fore and raised similar questions about the design process.

(1919/1961), Heath Robinson, Tinguely and the 'pataphysical inventions (and, indeed, the reasoning) of Jarry's (1911/2006) Dr Faustroll form an inverted version of this machine aesthetic.[30] This plays on our expectations of machines as being functional, rational and efficient through over-complication and contrasts their determinism and precision with the contingencies and unclear purposes of the everyday and the body. This second sense of the aesthetic of machines is implicit in the first: the idea of designing something to precisely act out some purpose raises the question of what this purpose is and why it is to be achieved, a question that, in the context of architecture, cannot be answered in a way that can be fully automated or optimised.[31]

The way machines embody processes, purposes and logical relations and in so doing reveal the contingencies of these has been an important reference point for me in all the projects that follow. In particular, especially in my interest in indexes in Part II, I have drawn on the use of machines as translation devices in art and architecture such as, for instance, in the work of Nicolas Schöffer (see for instance Reichardt, 1968, pp. 44-45; Spiller, 2006, pp. 204-205), Paul Etienne Lincoln, Neil Denari's Solar Clock (McCarter, 1987, pp. 22-25) and aspects of Neil Spiller's Communicating Vessels project such as the Velasquez Machine (see for instance Spiller, 2005). Translations such as these form an aesthetic balanced between control and chance and can be thought as what Spiller (1998b) has called the "second aesthetic…of the algorithm" (p. 62).

1.1.2.4 Cybernetics and radical constructivism

Both these themes (machines, design research) relate to cybernetics and the closely connected epistemological position of radical constructivism. Cybernetics is the theory of "all possible machines" (Ashby, 1956/1964, p. 2) in the abstract sense of a mechanism or process.[32] It

---

[30] See also Clair and Szeemann (1975), Clements (2006), Hultén (1968) and Volpert (2006).

[31] See for instance Negroponte (1970, 1975) as discussed below.

[32] The terms "machine" and "mechanism" can each be used in both an abstract and actual sense. While "mechanism" can be used to refer to an abstract causal process it is also suggestive of the cogs and wheels of a physical machine. Likewise, while we often use "machine" to refer to an actual device we can also use it in more abstract ways such as about the machinery of an organisation, for example "the war machine" (see also Raunig, 2010).

therefore relates both to actual machines (which it describes abstractly) and also to systematic processes such as that of designing. While cybernetics has often become associated with functionalism and determinism because of its use of terms such as "mechanism" and "control", it is by contrast a criticism of such objectivity.[33] Cybernetics is primarily concerned, firstly, with feedback and circularity, and so is in contrast to mechanical linear behaviour, and, secondly, with the inclusion of the observer (which is implicit in feedback) in contrast to objectivity. It is in sympathy more with the attitude to machines of Heath Robinson rather than with functionalism (see for instance Reichardt, 1968, 1971).

The relation between cybernetics and design research is significant. It is possible to build an extended epistemological analogy between cybernetics and design in terms of circularity (see below section 1.2.3). This is one way that the relation between the epistemological foundations of design has been explored in design research (for instance Glanville, 2007b; Glanville, 2007e; Jonas, 2007b; 2012, pp. 31-35; Krippendorff, 2007a). As well as this connection to design, the epistemology of cybernetics is related to ethical questions about our personal responsibility and participation in the world—especially in von Foerster (1991, 1974/2003, 1990/2003, 1976/2003) but also Bateson (1972/2000) and Glanville (2004/2009). Cybernetics therefore relates closely to design, to epistemology and to ethics. While it is more clearly connected to the design process than to architecture, it is associated with the recurring architectural theme of machines and, especially in the work of Pask and Grey Walter (Pickering, 2010, pp. 37-89, 309-377), has often attempted to physically embody its ideas.[34] Through this, cybernetics is often associated specifically with interactive architecture, although Pask's (1969) comments on Gaudi suggests a broader relevance to

---

[33] On the association of cybernetics with functionalism, see Pickering (2010, p. 371) on Pask's unfortunate terminology, referring to "modified" and "unmodified people" (p. 368). See also Heidegger's (1964/1977, pp. 377) and Baudrillard's (1968/2005, pp. 54, 127) associations of cybernetics with technological determinism.

[34] This tendency is stressed by Pickering (2010) who labels it "ontological theatre" (p. 17). This reference to ontology needs to be distinguished from the sense in which von Foerster criticises ontology as the making of objective claims about what is (von Foerster & Poerksen, 2002, pp. 26-27). Pickering's use of the word is in the pragmatic and performative sense of embodying and testing ideas in practice through physical devices.

how architecture is experienced and communicated. I have introduced cybernetics and radical constructivism more fully below (in section 1.2).

1.1.2.5 Deconstruction

There are several similarities between deconstruction (and post-structuralism) and cybernetics.[35] For both, the inclusion of the observer is crucial.[36] Like Pask's (1976) conversation theory in cybernetics (which I have introduced below; section 1.2.3.2), Derrida's deconstruction goes beyond structuralist criticisms of understanding language as a correspondence between words and things, understanding meaning as constantly being in flux rather than as located at the end point of a chain of referents (Coyne, 2011, pp. 23-24). Both understand any one topic to consist of at least two others and meaning to be constituted by this difference (Barnes, 2007, pp. 76-77; Hill, 2007, p. 16). Derrida's quest against metaphysical foundations can be compared to von Glasersfeld's (1991) concern with separating epistemological and scientific questions from metaphysical ones and also to von Foerster's (1991, 1990/2003) association of metaphysics with undecidability. Indeed the notion of undecidability is invoked in similar ways by Derrida (1972/2004, p. 229) and von Foerster (1991, 1990/2003), who both reference Gödel (1931/2004), as a way of questioning a dualism which keeps both possibilities in play (rather than simply affirming, inverting or resolving them) where any one resolution returns us to the original question because of there being something of each answer contained in the other.

---

[35] It is beyond the scope of my work to examine the parallels between cybernetics and deconstruction in enough depth to fully explore their possible relation. I have pointed out various points of possible connection which seem fruitful as a starting point for such a study.

[36] Von Foerster (1993, p. 38) notes that Pask's work anticipates the idea that it is the listener rather than the speaker that determines the meaning of an utterance. While the classic post-structuralist statement of this by Barthes (1967) precedes the finalised presentation of conversation theory in the 1970s (Pask, 1975a, 1975b, 1975c, 1976; Pask, Kallikourdis, & Scott, 1975; Pask & Scott, 1973; Pask, Scott, & Kallikourdis, 1973), the idea that meaning is the preserve of the listener rather than the speaker in the premise of all Pask's work and experimentation dating back to the 1950s.

Deconstruction has influenced architecture in a more explicit way than has cybernetics. It is closely associated with the architectural movement known as deconstructivism and particularly with Eisenman with whom Derrida collaborated (see Coyne, 2011, pp. 36-60; Kipnis & Leeser, 1997). Derrida (1986) calls architecture "the last fortress of metaphysics" (p. 69) in that it is obsessed with its foundations (in its concern with origins, teleology, dwelling and aesthetic categories such as beauty) which, because of architecture's material persistence, are hard to deconstruct (Coyne, 2011, pp. 59-60). However the application of deconstruction in architectural deconstructivism creates a paradox. While deconstruction is concerned with the destabilisation of codes, its application to architecture has depended on understanding architecture explicitly in terms of language and so with respect to such coding. To understand architecture in terms of language in this way is only one possible reading of it and deconstructivism's attempt to question such codes makes this reading explicit and so reinforces it (with the effect that deconstructivism has become a set of stylistic conventions itself). The way Eisenman attempts to undermine architectural conventions, excluding the observer as an arbiter of meaning and function, has the contrary effect of reinforcing his own authorship (see also Evans, 1985).

As Coyne (2011) suggests, Derrida's thinking is perhaps more suitably related to activist approaches to architecture, to radical forms of practice or to criticisms of architecture as an institution rather than to the formalist approaches to which it has predominantly been put in deconstructivism. Thus, while deconstruction, having many similarities with second-order cybernetics on the points on which my work is focused, could equally appropriately be used as a starting point for my research, the apparent advantage of its established connection to architecture (through Eisenman and others) is such that this instead obfuscates what its relation to architecture might be.

1.1.2.6 Phenomenology

The origins of phenomenology are, similarly to those of radical constructivism, with the epistemological question of realism and idealism. Phenomenology, and especially the work of Heidegger, has also been widely invoked in architecture by, for instance, Norberg-Schulz (1971,

1986), Frampton (1983), Harries (1997) and Vesely (2004). These authors largely draw on Heidegger's later work, which addresses or refers to a number of architectural themes such as dwelling (1951/1971, 1951/1977), place (1951/1977), technology (1955/1977), the Greek temple (1935/1977) and everyday items (1950/1971) but also to some extent on his (1927/1962) notion of being-in-the-world (e.g. Norberg-Schulz, 1971, p. 27) as well as to Husserl's (1936/1970) critique of science, Gadamer's hermeneutics (1975/1989) and Merleau-Ponty's (1945/1962) concern with embodiment.[37]

There are, at first sight at least, significant similarities between phenomenology and constructivism. Husserl's phenomenological reduction is similar to radical constructivism in its bracketing of reality, comparable to the cybernetic device of the black box (Ashby, 1956/1964, pp. 86-117; 1958/1991, pp. 252-255; Glanville, 1982, 2007/2009, 2009a), its first-person perspective (the inclusion of the observer) and its criticism of scientific objectivity. The bracketing of reality in phenomenology is however of a completely different character than that of the black box in cybernetics and constructivism.[38] The black box describes how we can build a usable understanding of the world while remaining ignorant of it. By examining the relations between our experience of the inputs and outputs of some system we can make explanations of their relation, and so of our experience of the system, without needing to know anything of the system's internal structure. These explanations are provisional as they are not based on what is inside the black box but on our experience of it and so we expect to revise them later on. By contrast phenomenology is concerned with passive descriptions of our experience and the phenomenological reduction is intended to limit the scope of observation to only those things of which we can be certain and thus to their

[37] Vesely (2010) gives a useful overview of these different sources. See also Kidder (2013) and Sharr (2007).

[38] The idea of the black box originated in physics with Maxwell (1871) although he did not use this particular phrasing (I am grateful to Albert Müller for this insight, personal communication, August 3, 2013). It is a major reference point for early cyberneticians such as Wiener (1948/1961) and Ashby (1956/1964) and also became widely used, in a slightly different sense, within engineering. On the relation of the black box to radical constructivism, see Glanville (2013) and von Glasersfeld (1974). While the black box is associated with first-order cybernetics, Glanville (1982, 2002b, 2009a) argues it exemplifies a second-order cybernetic understanding.

appearance. Cybernetics and constructivism, by contrast, understand even appearances as being constructed rather than directly given by the world (Lettvin, Maturana, McCulloch, & Pitts, 1959; Maturana, 1974/1995; von Foerster, 1973/2003; von Foerster & Poerksen, 2002, pp. 17-23). This difference is especially clear when it comes to what Husserl (1913/1998) calls the eidetic reduction—the removal of personal or accidental features to leave the impersonal essence of an experience. From a constructivist standpoint, however, there is always at least one feature of any observation which cannot be removed by an observer, that of the observer's own presence, because even to try to remove this is to make it manifest in one particular way. Thus, while phenomenology and constructivism both concentrate on the world of experience and bracket questions of reality they contrast with each other quite fundamentally. In phenomenology one makes passive descriptions while in constructivism one invents explanations and whereas phenomenology is concerned with what one can be certain of, in constructivism one anticipates and incorporates error. In constructivist terms, the descriptive nature of phenomenology marks it, despite its bracketing of the real, as implicitly realist.

Heidegger (1927/1962) radically reinvented the phenomenological method as a way of reaching beyond the appearance of things, which he calls their presence-at-hand, to their underlying equipmental nature or readiness-to-hand.[39] In this way he recasts phenomenology as less passive and in so doing makes parallels with constructivism possible—as incorporating circularity in the sense of hermeneutics (that our understanding of individual parts is through their context and that, vice versa, our understanding of context is through its parts, such that our interpretation is constantly developing) and as understanding us as being-in-the-world in the sense of being involved in it (and thus being part of our observations).[40] While Heidegger's prioritising of ontology is seemingly at odds with constructivism—see for instance von Foerster's remarks on "the terrible idea

[39] On the differences between the phenomenological method in Husserl and Heidegger see, for instance, Dreyfus (1991, pp. 30-33) or Harman (2007, pp. 15-24).

[40] Von Foerster (1993, p. 38) notes that one of the significances of Pask's conversation theory is that it contributes a foundation to the formalisation of hermeneutics.

of ontology" (von Foerster & Poerksen, 2002, pp. 26-27)—it can also be understood as an inclusion of the observer, in a similar way to von Foerster's (1990/2003, p. 289; 1972/2003, p. 195) observation that in order to have a theory of the brain one must first have a brain and so any theory of the brain must include itself. However, while Heidegger's reformulated phenomenology can be compared with constructivism in these ways, what made possible the initial similarity between Husserl's phenomenology and constructivism, the bracketing of the real, is lost. While Heidegger is not conventionally realist, he nevertheless proposes describing aspects of the underlying nature of things.[41] This leads to him claiming priority for his method and for particular ways of being as authentic in contrast to the pluralism and provisionality of constructivism. Thus while there are moments of connection between phenomenology and constructivism there are also substantial differences.

The significance of phenomenological thinking to architecture is twofold. Firstly in such notions as Husserl's (1936/1970) *lebenswelt* (lived world or life-world), Heidegger's (1927/1962) being-in-the-world or in Merleau-Ponty's account of embodiment, phenomenology implies a particular understanding of space, emphasising the experiential.[42] Drawing on these references, Norberg-Schulz (1971) criticises the naïve realism of understanding space as a uniform material to be modelled and instead defines architectural space as "a concretisation of man's existential space" (p. 12) which he contrasts with the tendencies to, on the one hand, leave out the observer by discussing space in terms of abstract geometry or, on the other, to reduce space to only perceptual impressions and sensations (p. 14). Norberg-Schulz's notion of existential space is comparable to the ordering of our spatial experience in radical constructivism—neither solely our experience nor that which causes this experience but instead something we are an active participant in making sense

[41] See also Glasersfeld's (2000) remarks on Heidegger's metaphor of thrownness as inevitably implying a "pre-existing ready-made world, a given structure *into* which all knowers are thrown" (p. 6).

[42] The notion of embodied cognition also has roots in cybernetics; see for instance Varela, Thompson and Rosch (1991) and Maturana and Varela (1987).

of—and indeed he draws on the constructivism of Piaget (1955; Piaget & Inhelder, 1956) for this part of his argument (Norberg-Schulz, 1965; 1971, pp. 9-12; 1986, pp. 29-31).

Secondly, as well as a phenomenological account of space, a phenomenological or hermeneutic approach can be taken to architecture and its history as has been done for instance by Harries (1997), Norberg-Schulz (1975, 1980, 1986) and Vesely (2004) as well as by Heidegger (1951/1977, 1935/1977) himself, albeit somewhat ambiguously. Vesely's approach is to analyse architecture's history to identify typical situations or spatial qualities which have remained more or less consistent throughout changes in culture and technology, understanding these as revealing aspects of spatial experience which are common to us all. One feature of such analyses is a concern with the natural conditions which underlie our spatial experience and what Harries (1997, pp. 180-200) refers to as the natural symbolism of spatial characteristics which follow from this, such as the horizontal and the vertical, up and down, the cardinal points and centre and periphery (see similarly Norberg-Schulz, 1971, pp. 17-36; 1975, pp. 30-31).[43] Such qualities have been recurring themes throughout the history of architecture and especially where buildings have been intended to reflect the cosmos in which they sit.[44]

This sort of analysis of what is natural or common is realist in the sense that it purports to describe underlying reality. Such accounts can however be interpreted in ways which are compatible with constructivism. The identification of patterns in history can be understood as something

---

[43] It is notable that in comparison with Norberg-Schulz, Vesely (2004) is much less definite about those qualities which he identifies, noting that "the reference to the horizontality and verticality of typical human situations should be taken as only an incomplete approximation of the given natural conditions…Any attempt to name all the primary dimensions would be futile, because they always arise from a dialogue rooted in a particular historical context" (p. 384). Vesely understands these qualities to be formed in a culture under the conditions of the natural world, rather than the conditions of the natural world itself, and so being subject to reinterpretation.

[44] Heidegger's (1950/1971, 1951/1977) notion of "the fourfold" (earth, sky, mortals, gods) can also be taken as a reference to this, as is done for instance by Norberg-Schulz (1971, p. 31; 1975, pp. 39-48). However, if Heidegger does intend that these terms be taken straightforwardly, he almost certainly means much more as well. For this reason referring to Heidegger tends to raise as many questions as answers. I return again to the question of the fourfold below (section 4.1.2).

constructed rather than discovered. The spatial conditions to which these patterns point can be interpreted as characteristics of our experience of the world rather than of the world itself (see similarly Vesely, 2004, p. 384) and the stability of such features can be explained as occurring through the sort of social interaction which von Foerster (1991, p. 72; 1976/2003) understood in terms of "eigen-behaviours" (that is, as the sort of stability which arises where a process takes its output as its new input in such a way as to converge onto a stable value or pattern of values).[45] Even in this interpretation there is nevertheless a lingering realism to any account of the underlying qualities of space in a similar way as in the sort of constructivism which von Glasersfeld (1985; 1991, p. 12) has labelled as being trivial as opposed to radical. To identify particular spatial qualities as underlying our experience is to speak in terms of a correspondence with the world even if it is with a world constructed culturally. However, while the identification of these qualities as underlying our experience is therefore a manifestation of being apart from the world, they are nevertheless ways in which the idea that we are part of the world has and might be expressed in architecture. This ambiguity encapsulates the relation between constructivism and phenomenology which share common origins and some significant similarities but which are fundamentally at odds.

1.1.3 Method

My account so far has set out the idea that we are part of the world, firstly, in an epistemological and an ethical sense, as manifest in designing, and, secondly, as a spatial idea of relevance to architecture. This topic can be explored in various ways but the choice of research method is not a neutral choice. This is not just because different methods lead to different possibilities but also because, given that the topic is in part epistemological, the method of exploring the topic is part of the topic itself. As the topic is concerned with the relation between philosophical theory (epistemology, ethics) and practice (architecture, design), the key methodological choice is

[45] See also Kauffman (2003, 2005, 2009). Von Foerster uses this mathematical operation as a metaphor for understanding how stability arises in social phenomena such as languages or customs even though, from a radical constructivist point of view, we each construct our own understanding of these things independently. That is, it is an example of a process where we experience a concept as both stable and shared even though it is dynamic and individual.

how to bring these together. There are, broadly, three different forms this could take: firstly, that of putting theory first and applying it to practice; secondly, that of putting practice first and developing theory from it; and, thirdly, that of investigating both together simultaneously.[46]

Treating practice as the application of theory is reminiscent of the attempt to apply the scientific method to design which has been widely criticised. Schön (1983/1991) describes how this, which he calls "the model of Technical Rationality" (p. 21), implicitly separates research and knowledge from its application, such that practice becomes understood as instrumental problem solving. Reservations about such an approach include for instance: that importing theories external to design into design discourse can obfuscate the nature and expertise of design (Cross, 2007a, pp. 123-124); that there is a considerable distance to be bridged from such theory to practice and that the question of how to act is therefore left unanswered; and that, in bridging this, design can end up merely aestheticising or illustrating theory rather than responding to it. For these reasons design research has moved beyond this paradigm, understanding design's epistemology in its own terms rather than in terms of other theories or scientific method (Archer, 1979, 1995/2012; Cross, 1982, 2007a; Cross, et al., 1981). The relation between architecture and ethics is most straightforwardly thought of as the application of ethical theories to the ethical questions which are raised in the context of design (for instance: professional ethics, technology, sustainability, participation). However, while approaching ethical questions in ethical terms is important in clarifying them, it is not as if normative ethics is a settled body of theory which can be applied without doing so involving the arbitrary choice of one reference point over others. As well as this arbitrariness, approaching ethical questions in terms of applying ethical theory to practice creates a paradox given my topic, as

[46] These can also be thought of, respectively, in terms of the terminology of research for design, about/ into design and through/ by design as originally introduced by Archer (1995/2012) and Frayling (1993) and more recently clarified by Jonas and others (Chow & Jonas, 2009; Jonas, 2007a, 2012). See also the criticisms made by Friedman (2002).

it will tend to present that theory as an authority from which actions can be determined even if the theory doesn't claim this itself.[47]

As well as applying theory to practice, it is possible to build theory from practice.[48] This topic could be explored by investigating how designers have dealt with such questions, either: (1) in in terms of architectural precedents, studied through a historical or hermeneutic approach such as that of Harries (1997), Norberg-Schulz (1975, 1986) and Vesely (2004); or (2) in contemporary case studies of the design process, studied through interviews, protocol studies or archival material (such as by Cross, 2007a, pp. 65-97; Dorst & Cross, 2001; Gedenryd, 1998; Goldschmidt, 1991, 1995; Kenniff, 2011; Krippendorff, 2006, pp. 221-230; Lawson, 1979; Schön, 1983/1991). In both cases this has the advantage of understanding design and architecture in their own terms and so being immediately applicable, suggesting possible architectural and epistemological strategies. Many of the sources on which I draw are understandings of architecture and of the design process which have been developed by others in this way. On its own however, such an approach tends towards being conservative, in that it is concerned with what has already been done rather than what could be the case in the future (see also Krippendorff, 2007b), and tends, in that it is descriptive, towards realism in assuming that there is an answer out there to be found (and so conflicts with the position I am exploring). This descriptive nature is especially the case in using this method to explore ethics. Case studies can only contribute to a descriptive account of ethics (that is, of the ethical principles held by an individual or group) rather than to wrestling with ethical questions themselves.

Rather than apply theory to, or build it from, practice, my method has been to hold practice and theory together. I have approached this in two different ways, in two parallel investigations,

---

[47] This is another instance of the ethical question of ethics—that, as von Foerster (1990/2003) describes and as I have discussed below, any explicit discussion of ethical ideas tends to come across as moralising even when this is not implied by the ideas themselves.

[48] On building theory from practice see also Barnes (2002), Glanville (2004a) and Piaget's (1955) discussion of the child's construction of constant objects. This was also a theme of the 2013 American Society for Cybernetics conference held at the Institute for Educational Cybernetics, University of Bolton, Bolton, which I participated in.

which are concerned with two different aspects of practice: firstly, with that of the expertise of the discipline of design as explored in design research; secondly, with my own design investigations. While I have pursued these independently at first, I have then drawn them together so that they reflect on each other.

In the first of these investigations (Part II), beginning from the epistemological and ethical senses of our being part of the world, as manifest in the practice of design, I have explored what this suggests for how we approach the sort of complex situations with which ethics is often concerned (thus inverting the more usual application of ethical theory to design practice). The method of this argument is closely related to cybernetics—being both dependent on it, in substantiating its key analogies (between design, epistemology and ethics) and also taking the form of how these cybernetic arguments have been made, through building analogies between different fields in terms of their abstract mechanisms.

The second approach I have taken (Part III) has been to respond to the spatial and architectural senses of our being part of the world, investigating this through my own design projects and reflections on them.[49] This sits in the context of practice based design research. There is now a substantial body of literature underpinning design as a research methodology (see for instance Grand & Jonas, 2012; Michel, 2007) and it has even been argued that design underlies more traditional research paradigms (Glanville, 1981, 1999b; Jonas, 2007b). The idea of a practice-based approach is to situate theory by trying to use it and so to explore an idea by understanding its consequences. This is to take the process of designing as a research environment. In this my designing has been my way of researching and writing this thesis has been my way of explaining this,

[49] It might be suggested that a similar approach driven by my own design work should be adopted throughout and that I should build the epistemological observations of design that are a key feature of Part II by reflecting on my own work. I have decided instead to base those parts of my account on a more general understanding of the epistemology of design, drawing on the literature of design research, as my concern is with the expertise implicit in design's most basic methodology rather than in any particular manifestation of it. While I have made cross references to my own work where appropriate, I have wanted to avoid the idiosyncrasies of my own particular practice obfuscating the more general structure of design.

leading to theorising which has then in places returned to influence my designing. To explore an idea through practice is not to argue that a particular design approach follows from that idea or that it embodies that theory. In any design project the particular path that we take is just one amongst many possibilities. The point of such an investigation is not to be comprehensive as to the consequences of an idea (which from a radically constructivist understanding is impossible in any case) but to explore some of that idea's qualities and use these to reflect back on the idea itself.

These two investigations relate to each other but not in the linear sense that one follows from the other. My design projects do not follow as a consequence of my theoretical ideas or as illustrations of them and neither have my more theoretical investigations been concerned with explaining or justifying the projects I have made. Rather, by exploring different aspects of an idea in parallel they have intersected in ways that I did not predict and which have made it possible for me to question some of the ideas with which I have begun in such a way as to lead to new possibilities of practice.

1.1.4 Outline

I have arranged this thesis in four parts. In this, the first, I have so far introduced the themes with which I am concerned as well as the principle sources to which I have referred and the research methods that I have adopted in exploring them. In discussing method I have already indicated something of the structure of what follows and in this section I expand on this more fully. In the two sections of Part I subsequent to the present one, I introduce the two initial starting points from which my work follows. In the first of these I give a more substantial account of cybernetics and radical constructivism than I have done so far. In particular I review those aspects that are important to my later argument: the undecidability of epistemology; the relation between cybernetics and ethics; and the analogy that can be made between cybernetics and design. The second starting point that I introduce takes the form of a design investigation into the contingencies and tolerances of design decisions and how these might be embodied in the forms of objects.

Parts II and III form a pair of parallel investigations which both take their point of departure from aspects of the idea that we are part of the world, with Part II beginning from the

epistemological and ethical senses of this idea and Part III from its spatial and architectural aspects. They are parallel both in the sense that Part III does not follow logically from Part II (it is not the consequence of Part II in practice) and also in that they were undertaken simultaneously. Both are based on observations of design but in different ways. Part II draws on the understanding of design (from the literature of design research) as a discipline with its own epistemological foundations and claims to expertise, especially in dealing with complex or ill-defined situations, while Part III is based on my own design investigations into ways of heightening the spatial experience of our being part of the world.

In Part II I begin with an account of the distinctively conversational epistemology of designing and the advantages of this in the context of the ill-defined and complex situations which designers typically face. Understanding at least some ethical situations (such as for instance those which designers encounter) to have a similar structure, I argue below that the epistemological expertise of design might also be understood ethically. The possibility of this analogy is suggested by cybernetics, the epistemology of which has both been likened to design and also said to coincide with ethical questions. In Part II my account: (1) suggests ways in which design, ethics and epistemology can be read together; (2) reflects on the ethical implications of cybernetics through design; and (3) contextualises these suggestions with respect to ethical discourse.

Part III takes as its point of departure the sense in which we are spatially part of the world and explores ways in which our experience of this can be heightened architecturally. It comprises two design investigations. My starting point for the first is my enjoyment of those situations where our bodily presence in a place sometimes leaves behind traces of our activity as an index of it. Taking this as a point of departure, I have proposed some ways in which similar indexes might be constructed through a variety of translation devices and how these might transform our experience of the situations they record. While this first set of projects is concerned with our presence in the world, the second shifts focus to the presence of the world around us. My point of departure for these projects is those qualities of space that I take to be common in our experience (drawing on the phenomenological accounts of spatiality that I have introduced above). In these projects I have

proposed some ways in which these qualities can be read into everyday situations and how such an interpretation of a place might be made more explicit.

As well as exploring the potential of the particular approaches that I have taken, the projects of Part III raise epistemological and ethical questions of their own that intersect with those of Part II. While these are noted where they arise in Part III, in Part IV I have identified three of these intersections in particular. These reflect on and develop aspects of the epistemological, ethical and spatial senses of our being part of the world which I have introduced. I have then developed a way in which these three ideas can be explored in a new design investigation and present the beginning of my attempts to do this. Lastly I have concluded this fourth and final part by summarising the major points I have made and their significance.

1.2 Starting points (1): Second-order cybernetics and radical constructivism

One main starting point for this thesis is the epistemological and ethical account given by second-order cybernetics and radical constructivism.[50] I have briefly introduced this above in terms of what it is not: understanding epistemology as not being concerned with a correspondence between our understanding and the world; and ethical action as not merely conforming to a moral code. In this section I give a fuller account of the three areas of cybernetics which are important to my argument: (1) that of the epistemology of second-order cybernetics and radical constructivism; (2) that of the relation between cybernetics and ethics and (3) that of the analogy that can be made between cybernetics and design.

1.2.1 Cybernetics and epistemology

1.2.1.1 Circularity

The founding concept of cybernetics is circularity in the sense of feedback. This is invoked in the term cybernetics itself, which is derived from the Greek *kybernetes*, meaning steersman.[51] Steering a ship implies a goal towards which to steer and hence a purpose in the action of steering

[50] I have used the labels radical constructivism and second-order cybernetics interchangeably. The fundamental observations of each entail each other (Glanville, 2013). It is because observation is a circular form of interaction that we are part of it; because we are part of it that we cannot verify it objectively; and because our understanding cannot be objectively settled that we continue to adapt it in response to our experience (using circular feedback) so it remains viable.

[51] Wiener (1948/1961, p. 12) notes that it was for this reason that he chose *Cybernetics* as the title of his book as it was his work with steering and targeting (such as Rosenblueth, et al., 1943) which had led him to his initial ideas about feedback (see also Wiener, 1958). At the Macy Conferences in which cybernetics was developed, von Foerster, who was acting as conference secretary in order to improve his English, suggested that the title of Wiener's book be taken as the title for the conferences which led to it becoming accepted as the name of the discipline (von Foerster & Poerksen, 2002, p. 136).

which is achieved through a feedback mechanism.[52] The steersman compares the direction of the ship's present course with that towards its destination, observing, say, that it is heading a little too far to the left or the right, and then changes the angle of the rudder in response. The rudder changes the ship's course and the steersman compares this new course with the direction of the goal and adjusts again as required. This is a continuous process and forms a circular feedback loop. It is circular in the sense that the outcome of the activity is taken as the input for continuing that activity. This creates stability—the steering absorbs changes in circumstance caused by the wind or tide and keeps the ship on course—and this allows for a purpose to be pursued.

1.2.1.2 Second-order cybernetics

Second-order cybernetics follows from this initial concept of circular feedback and applies it to cybernetics itself—hence *second-order* cybernetics, which can also be rendered as the cybernetics of cybernetics (Mead, 1968; von Foerster, 1974/1995, 1979/2003)—recognising that in a cybernetic account of observation one cannot remove the observer as they are part of the circularity of the system that is being studied. This applies both to the analysis of a situation such as steering a ship (the steersman is a part of the system of steering) and also to the performance of cybernetics (in observing the steering of a ship we are part of a system of observation).[53] The change of paradigm between first- and second-order cybernetics is summarised in the distinction between being part of and apart from the world, which I have introduced above: in a first-order account one describes the world objectively as an independent observer; in a second-order account one is part of the world and so part of one's own observation.[54]

---

[52] One of the significant aspects of this (and in particular of Rosenblueth, et al., 1943) is the reintroduction of the notion of purpose into scientific discourse where it had been discounted because of its association with final causes, an association which understanding it in terms of feedback circumvents, as Stewart (1959/2000) points out.

[53] See also Gage (2007a) and Glanville (1997).

[54] Von Foerster (1974/1995) characterises the difference between first- and second-order cybernetics as being between, respectively, "the cybernetics of observed systems" and "the cybernetics of observing systems" (p. 1), a distinction which parallels his later distinction between our being part of and apart from the world. That is, while first-order cybernetics

Although explanations of second-order cybernetics tend to contrast it with earlier cybernetics, it is misleading to see this as a fundamental break or only in terms of the chronological development of cybernetics. While second-order cybernetics developed subsequently to many other cybernetic ideas, and is sometimes for that reason known as "the new cybernetics" (Pask, 1996, p. 353), the *first* and *second* in first- and second-order cybernetics do not refer to distinct eras but to the inclusion or otherwise of the observer.[55] This distinction is developed and formalised with the advent of second-order cybernetics but one can see the ideas of second-order cybernetics to be implicit in earlier cybernetic ideas and especially in the central cybernetic theme of circularity.[56]

The difference made by the inclusion of the observer can be seen in the eponymous cybernetic example of steering a ship. Whereas in first-order cybernetics we might describe the goal of such steering in terms of the target destination (the port to which the ship is travelling etc.) and so as an external condition at which the steersman aims, in second-order cybernetics the goals of a system are understood to be within it. Thus in a second-order account the goal of the steersman is not arriving at the port but the state of being on course for the port. This goal is a stable relationship between each element of the system—between steersman, port, ship and sea—rather than identifiable as any one element or event.[57] Thus in second-order cybernetics purpose is not just a

---

is concerned with the observation of systems, second-order cybernetics is the observation of this cybernetic act of observation.

[55] It is for this reason that, as Glanville (2002b) and von Foerster (von Foerster, 2003, p. 301) have both pointed out, that any third- or fourth-order cybernetics will essentially be collapsible back to first- and second-order cybernetics rather than new innovations.

[56] This is especially the case with Ashby, Bateson and Mead and to some extent even Wiener (Glanville, 2007/2009, p. 372). Ashby (1958/1991, pp. 252-253), for instance, speaks of the investigator and investigated as one compound system.

[57] Depending on what one is trying to explain, one could describe this system of steering: (1) as being expanded to include the destination and context (connecting steersman, port and sea); (2) as being all within the experience of the steersman (between the steersman's experience of steering and observation of the port and sea); or (3) as the relation between steersman and rudder (see Gage, 2007a).

matter of striving towards some "specific final condition" (as for Rosenblueth, et al., 1943, p. 19) but a continuing quality of the system.[58]

1.2.1.3 The undecidability of epistemology

Although I have already introduced the idea that the question of epistemology is undecidable above, I restate it briefly here. As von Glasersfeld (1974, 1984) describes, epistemology has traditionally been concerned with the trustworthiness (or otherwise) of the match or correspondence between our understanding and the real world (that is, the world as it exists before it is observed) and so with certainty and truth. There is however no way to verify such a relationship as one cannot in principle compare one's observation of the world with the world before it is observed because the attempt to do so involves further experience. Von Glasersfeld (1974, 1984) presents his constructivism as radical because it differs from this tradition fundamentally.[59] Both the epistemological question of the relation of our experience to the world beyond it and also the ontological question of whether there is such a world are therefore in principle undecidable questions. Recognising this, Von Glasersfeld proposes putting these questions to one side and refocusing epistemology on experience.[60]

Von Foerster (1991, 1990/2003) formulates this fundamental question of epistemology in the undecidable choice he presents us with as to whether we are part of or apart from the world we observe. In one sense this presents us with the traditional opposition between realism and

---

[58] Similarly in second-order cybernetics control is understood not as the hierarchical control of one part of a system by another but as a quality of the circularity of the system as a whole.

[59] The radicality of radical constructivism is that it differs from the traditional understanding of epistemology in terms of its roots—the etymology of the word radical coming from the Latin *radix* or root.

[60] Radical constructivism has been criticised on the basis that it implies ontological solipsism or similar subjectivity (see for instance the criticisms of Garrison, 1997; Martínez-Delgado, 2002; Ogborn, 1997; Suchting, 1992). Von Glasersfeld is however agnostic regarding the ontological question of reality and the epistemological question of realism. He does not claim that there is no reality beyond our experience but that we can't in principle have certain knowledge of such a reality or of its absence because we cannot in principle escape our experience. See also Quale (2007).

idealism.[61] However von Foerster's formulation does not fit this familiar polarity but instead destabilises it by incorporating the self-reference with which radical constructivism is concerned.[62] In so doing it becomes not just undecidable in the wider sense of having no one correct answer but in the more special sense of each possible decision being such that it reopens the question.[63] If I decide that I am part of the world, then I am immediately brought back to the undecidability of this decision and that this decision amongst others is one that could equally be resolved otherwise. To decide that I am part of the world is therefore both to resolve the undecidable question and to maintain its undecidability and the possibility of deciding it otherwise.[64] If I instead decide that I am apart from the world, in recognising the undecidability of this decision I return to my responsibility and involvement in this question and so to being part of my understanding of the world. Therefore whichever way the question is decided one is returned to one's responsibility for answering it.[65] Thus this formulation of the realism-idealism question is not merely a revision of its terminology but of the choice itself. Both idealism and realism are examples of disconnection from the world (apart from)—objectivity and realism discount the properties of the observer, while subjectivity and idealism discount the properties of the observed. In this sense being part of the world contrasts simultaneously with both realism and objectivity and also idealism and subjectivity and is instead to

---

[61] Especially where von Foerster (1991) reformulates the question as "Is the world the primary cause? (That is, my experience is the consequence.) Or is my experience the primary cause? (That is, the world is the consequence)" (p. 65).

[62] As well as the self-reference this is also suggested by von Foerster's choice of terminology: while realism is associated with the neutrality and independence of being apart from the world, so too is idealism, which implies the isolation of the observer.

[63] This is the form of undecidability identified by Gödel (1931/2004). See also the collection of paradoxes by Hughes & Brecht (1975/1978). There are other forms of undecidable questions, such as where incommensurable requirements come into conflict (for example what Rittel (1972) called wicked problems) and also where the question leaves choice under-constrained.

[64] For this reason radical constructivism does not insist on itself being a true account. As von Glasersfeld (1990a) notes, to do so "would be perjury for a radical constructivist" (p. 19).

[65] The only way this question does not reopen itself is if one does not treat it as undecidable—that is, if one doesn't recognise the self-reference of observing one's own observation.

understand the observer and observed as inseparably intertwined through the circularity of feedback.[66]

Despite insisting on the undecidability of the choice between being part of or apart from the world, von Foerster is also dismissive of objectivity.[67] It is the nature of undecidable decisions that they are to be decided but von Foerster (1990/2003) dismisses objectivity out of hand rather than displaying the sort of tolerance we might expect in the case of an undecidable decision. Von Foerster calls objectivity "a popular device for avoiding responsibility" (p. 293), arguing that it entails the nonsensical principle that "the properties of the observer shall not enter the descriptions of his observations" (p. 288) and that "objectivity is a subject's delusion that observing can be done without him" (von Glasersfeld, 1981, p. 3).[68] This is explained by the self-reference of the question which causes self-contradiction. If I decide that I am apart from the world, I am brought back to my involvement in this question and so to my being part of the world. In maintaining this position (apart from) I must therefore either not be aware of this, and so not realise my responsibility for the question, or else have chosen to assert that I do indeed observe the world objectively, a position which has the effect of denying responsibility for its assertion. These aspects are nested within the general criticism of objectivity as being a way of avoiding responsibility.

---

[66] While von Foerster doesn't put it this way and, for the most part only criticises objectivity (although see also von Foerster, 1979/2003, p. 285), it seems to me that this follows from his account and that this way of criticising both objectivity and subjectivity in the same terms, rather than in terms of each other, is an underrated significance of second-order cybernetics.

[67] While von Foerster is strongly critical of objectivity he does make frequent use of the sort of instrumental thinking (mathematics, physics) that follows from it. According to Glanville (personal communication, February 13 2013), von Foerster explained this as being like using a metro system, providing a quicker way to get from one place to another. The undecidability of the question means that we can decide it differently in different situations and different times as we find most helpful.

[68] While this latter phrase is often attributed to von Foerster, it is ambiguous whether it originated with him or von Glasersfeld or whether they came up with it jointly. The confusion arises because when von Glasersfeld (1981) makes this remark it is unclear whether or not he is quoting from von Foerster. Whatever its origins, the idea is a shared one.

1.2.1.4 Viability

Not only is the undecidability of epistemology entailed by the circularity of cybernetics (the observer being part of the circularity of observation cannot verify its objectivity), it also entails it: it follows from this undecidability over the fundamentals of epistemology that our understanding is always uncertain and so awaits further improvement through feedback. It is not just that our observation is partial (that we see from our point of view only) but that even in its partiality our understanding always remains provisional. This is the case however much it is revised and improved. Our understanding relates to our experience rather than to the world and it is therefore always awaiting further revision in light of our future experience. Given this, the criterion of epistemology is not the truth of our understanding, in the sense that it corresponds with the world, but its viability—that it fits with our experience (von Glasersfeld, 1980, 1984; 1990a, pp. 23-25).[69]

One way of understanding viability is via analogy with evolution, where Darwin's theory is understood as "the elimination of the unfit" (von Glasersfeld, 1990b, p. 35) rather than the survival of fittest.[70] The possibilities of what explanation can fit our experience of a situation, like the possibilities of organisms which fit with their environment, are extremely broad.[71] While it follows that how we understand the world is a matter of choice between various viable possibilities, this does not entail that there are no constraints and that we can construct any understanding of the world that we wish to (and hence it does not equate to epistemological solipsism). Just as organisms which do not fit with their changing environment die out, so too ideas which no longer fit with our

---

[69] Note that the viability of an explanation is its fit with our experience rather than with the real world and the radical constructivist idea of viability therefore makes no claim as to the relation between our experience and the world beyond it. It is not therefore a lurch towards realism as Martínez-Delgado (2002) suggests.

[70] That is, in terms of fit in the sense of something fitting with its context rather than being fit in the sense of an athlete. A similar analogy between evolution and epistemology is made by Bateson (1972/2000, pp. 454-471).

[71] Thus ideas may well survive where they are useful even if they are naïve—as von Glasersfeld (1984) puts it, "in nature, a lack of fitness is invariably fatal; philosophers, however, rarely die of their inadequate ideas" (p. 4). Bateson (1972/2000, pp. 486-487) has noted the persistence of naïve realism (using the example "you see me") as being because its erroneous premises work.

continuing experience become unviable (von Glasersfeld, 1980, 1984, 1990a, 1991; von Glasersfeld & Cobb, 1983).[72] While we can construct any understanding that we wish to, if it is to be useful it must remain viable given our continuing experience (which includes our experience of others). For instance, if I understand the world in such a way that it is possible for me to walk through this table (an example that von Glasersfeld (1990a, p. 24) himself uses) and I find that I cannot do so in practice, then this understanding is no longer viable given my experience. I must therefore discard it or else adapt it in some way to include this experience.[73] The notion of viability is therefore an instance of cybernetic feedback—we construct an understanding of the world, test it out through our continued experience and revise it in light of our new experiences.

Of those explanations of some experience which are viable, there are no objective grounds to choose one over another but only instead a variety of different viable ways of doing so. This is not to say that we are to think of all viable explanations as equivalent to each other and the choice between them as being an arbitrary one. We can still make the case that one understanding is better than another in any terms we wish to—that for instance it is more useful, that it is simpler, that it holds in a wider range of situations (an instance of Occam's razor) or that it embodies other values to which we ascribe.[74] The ground for such preference, however, must itself be chosen. The choice between viable explanations is therefore undecidable and it follows that we are ultimately responsible for our own understanding of the world. In the undecidability of these choices, a radical

[72] This is consistent with the idea, advocated by Popper (1963), that science is concerned with the falsification of ideas rather than the verification of them (von Glasersfeld, 1996; von Glasersfeld & Varela, 1985), although there are significant differences between von Glasersfeld's position and that of Popper (see von Glasersfeld, 1995, pp. 21-22).

[73] This is what Piaget (for instance 1955) described as accommodation (see also von Glasersfeld, 1974, 1982, 1989a).

[74] See also Bateson (1972/2000, pp. 38-58) on explanatory principles.

constructivist understanding of epistemology is axiological—that is, it is concerned with choices of value which we would normally associate with ethics or aesthetics.[75]

1.2.2 Cybernetics and ethics

1.2.2.1 The coincidence of ethics and epistemology in cybernetics

The relation between cybernetics and ethics is not so much a case of cybernetics occupying a particular ethical position but that its epistemological questions coincide with ethical ones about responsibility, choice and our relations with others (Kersting, 2005, p. 415; von Foerster, 1974/2003, p. 244). The most significant account of this is that given by von Foerster (1991, 1974/2003, 1990/2003, 1976/2003, 1973/2003). Similar accounts have been given by Glanville (2005, 2004/2009) and by Bateson (1972/2000).[76] Glanville (2004/2009, pp. 297-303) argues that the epistemological devices of second-order cybernetics—such as that of the black box (Glanville, 1982, 2009a); difference or distinction (Bateson, 1972/2000, p. 315; Spencer Brown, 1969/1973); autonomy or autopoiesis (Varela, Maturana, & Uribe, 1974) and conversation (Pask, 1976)—depend on ethical qualities in order to function.[77] The structure of Bateson's (1972/2000) account is similar, directly connecting epistemology with our relations with each other and with the environment.

---

[75] While this is not claimed explicitly by von Glasersfeld, it follows, as I see it, as a consequence of shifting the criterion of knowledge (knowing) from correspondence (with the world) to viability (with experience) and is what underlies von Foerster's (1974/2003, p. 244) claim that in cybernetics epistemological and ethical questions coincide.

[76] Bateson, Glanville and von Foerster are the main writers who I have referred to as making a connection between the epistemology of cybernetics and ethics. Von Glasersfeld (1995, p. 127; 2000, p. 6; 2009) only addresses ethics briefly. Kersting (2005) draws heavily on von Foerster, as does Thyssen (1992) who relates von Foerster to Luhmann. While Luhmann's work also connects cybernetics with ethical considerations, it is concerned more with ethics as manifest in social systems and so in terms of ethical norms rather than, as here, in epistemology.

[77] Glanville notes in particular: generosity, honesty, learning, mutuality, open-mindedness, respect, responsibility, selflessness, sharing and trusting. While he refrains from positioning this within contemporary ethical debates, it makes sense to contextualise this in terms of the recent resurgence of virtue ethics. These qualities can be understood as virtues in that they help us to act (to live our lives) where we have understood what it means to act in a way informed by cybernetics. This is however not necessarily an argument for a virtue account of ethical reasoning, but rather just for the importance of some particular virtues and for the value of cybernetics as a way of acting.

Across these different accounts it is possible to highlight two themes: firstly that of our ultimate personal responsibility; secondly that of our participation with others and with the world.[78] While these are in contrast, they do not come into conflict when understood in terms of cybernetics but are complementary and even imply each other.

In a cybernetic or radically constructivist understanding of epistemology, we cannot escape responsibility for our understanding (it is our construction; our ordering of our experience) or for how we understand how we understand (the fundamental question of epistemology remains undecidable even after we have decided it). We are therefore ultimately responsible for our own actions and their consequences. This responsibility is also present in understanding the criterion of epistemology as viability, as this, in contrast to correspondence, leaves us with undecidable choices and so with questions that are axiological in character (that is, with questions of value). As well as epistemology involving ethical questions about responsibility and choices of value in these ways, ethical questions themselves involve the same self-reference which is the basis of radical constructivism. Just as we cannot examine our observation of the world except via observation, so too we cannot in principle value our own values except again through our values and we cannot therefore do so objectively.[79]

The second theme, our participation with others and in the world, is implicit in the circularity of all cybernetic accounts—especially those of Bateson (1972/2000), Krippendorff (1996), Mead (1968), Pask (1976) and von Foerster (1991, 1979/2003; 1990/2003, pp. 295-297). While participation can be thought of as a value in itself, the point here is not that cybernetics achieves such a value but, rather, that it always involves ethical questions of this order. That is, to practice cybernetics is to act in terms of others and so in the context of ethical questions. This is not however

---

[78] These two themes map neatly onto von Foerster's (1990/2003) concerns with undecidability and dialogue and are both bound up together in Bateson's (1972/2000) account of ecology and epistemology. The numerous ethical qualities which Glanville (2004/2009) notes as implicit in cybernetics can also, I think, all be understood in terms of these two themes.

[79] As with radical constructivism, this is independent of the question of whether there are or are not objective or universal values. Even an objective value cannot be claimed objectively because we must claim it.

to anthropocentrically equate ethical questions only with interpersonal relationships—in cybernetic terms the other in circularity might be the environment or even oneself. While von Foerster (1991; 1976/2003, p. 267) associates ethics with others, in Pask's (1972, 1976) understanding of conversation, many p-individuals (psychological individuals: the participants in the conversation) may be embodied within one m-individual (mechanical individuals: bodies or machines) such that one can have a conversation with oneself (Barnes, 2007, pp. 82-83). In this sense cybernetics shows how ethical questions, understood in terms of the relation between oneself and others, can also be said to apply to individuals in their relation with themselves.

1.2.2.2 That ethics cannot be articulated

Von Foerster (1990/2003) draws a distinction between morals and ethics which is based on that he makes between being part of and apart from the world:

> In the first example [being apart from the world], as a result of my independence, I can tell others how to think and act, "Thou shalt…" "Thou shalt not…" This is the origin of moral codes. In the second case [being part of the world], because of my interdependence, I can only tell myself how to think and act, "I shall…" "I shall not…" This is the origin of ethics. (p. 289)

The obligation of a moral code can only be justified by an objective observer who either discerns moral laws that exist independently of us in the world (that are for instance discoverable in nature or given by God) or devises such laws through reason.[80] If we understand ourselves as a part of the world, we cannot claim our judgement as objective or universal and so as having moral force in this sense.[81]

---

[80] Note, though, that even divine revelation cannot in principle lead to objectivity with certainty. As Sartre (1946/1948, p. 31) notes of the Abraham of Kierkegaard's (1843/1985) *Fear and Trembling*, he should have questioned not only whether it was the voice of God which commanded him but also whether he was indeed Abraham.

[81] The point of von Foerster's juxtaposition of morals and ethics can become lost in its terminology. The terms "ethics" and "morals" are often used interchangeably with each other but can also be used to make various distinctions such

As with radical constructivism's attitude to questions of epistemology or ontology, this does not necessarily imply ethical relativism (that ethical judgements are personal or social) or nihilism (that nothing is ethically preferable to anything else).[82] Rather, similarly to the parallel question in epistemology, the question of the objectivity of a moral code cannot in principle be answered as we cannot remove ourselves from it (we cannot value values independently of our own values) and any answer we give reopens the question—if I decide that there are objective moral truths, then I have decided this and am responsible for the decision; if I decide that I am responsible for my own ethical values then, becoming part of them, I am brought back to the possibility that there may be other values which I have not yet considered.[83] We are therefore ultimately responsible for our own ethics and, as von Foerster (1990/2003) goes on to argue, the objectivity of morality is not only unjustified in the claims it makes on others but it also avoids responsibility for those claims:

> With much ingenuity and imagination, mechanisms have been contrived by which one could bypass this awesome burden. Through hierarchies, entire institutions have been built where it is impossible to localise responsibility. Everyone in such a system can say, "I was told to do 'X.'" On the political stage, we hear more and more the phrase of Pontius Pilate,

---

as the one von Foerster proposes. Another such distinction, which is relatively common, is to understand morals as referring to personal conduct and ethics as referring either to the philosophy of this (normative ethics) or to those general principles (ethical norms) which are to be put into particular practice. These definitions in one sense use the terms morals and ethics the other way round (morals referring to the realm of personal choice in one, ethics in the other). From the constructivist point of view however these two definitions partly merge because ethical principles are understood as matters of personal responsibility and any explicit account of such principles tends towards moralisation.

[82] It could perhaps be classified as moral scepticism but only in the sense that radical constructivism develops the position of the sceptics; that is, not in the polemical sense that ethics cannot be known (which is a form of nihilism) but that it cannot be known whether it can be known.

[83] While it is possible to reach similar conclusions from the effect of epistemological uncertainty on practical ethical deliberation (that I cannot know what to do because I do not know the full context of the situation and cannot predict the consequences of my action), this can also be argued, such as by Kant (1797/1898), to lead to a rule based conception of ethics (that because we cannot be sure of the consequences of an action we should not second guess them). It is therefore significant that my argument here is made on the basis of a parallel with epistemology in terms of us being part of the world rather than as a consequence of it.

> "I have no choice but 'X.'" In other words, "Don't hold me responsible for 'X.' Blame someone else." This phrase apparently replaces, "Among the many choices I had, I decided on 'X.'"
>
> I mentioned objectivity before, and I mention it here again as a popular device for avoiding responsibility. As you may remember, objectivity requires that the properties of the observer be left out of any descriptions of his observations. With the essence of observing (namely the processes of cognition) having been removed, the observer is reduced to a copying machine with the notion of responsibility successfully juggled away. (p. 293)

While this responsibility means we must judge ourselves, we have no justifiable way to judge others as there is no standard that can be invoked objectively. Given this, claims to truth or morality lead inevitably to conflict as their veracity can only be asserted against that of competing claims advocated by others (von Foerster & Poerksen, 2002, pp. 30-31).

The most obvious implications of these observations seem to follow straightforwardly: (1) to avoid moralisation or paternalism towards others; (2) to recognise the uncertainty of one's own values; and (3) to acknowledge one's ultimate responsibility for them and for any would be authorities that one invokes.[84] However, in a more challenging way this also reflects back onto ethics itself such that, as von Foerster puts it (following Wittgenstein, 1921/1974, 6.421), "ethics cannot be articulated" (von Foerster, 1990/2003, p. 290). That is, if we speak about ethics, in making it explicit, we inevitably end up moralising. While this clearly applies to those ethical theories which make explicit moral claims on others, it also applies to itself (to von Foerster's account and to my

[84] This includes taking responsibility for advocating these principles; i.e. taking responsibility for advocating taking responsibility. Putting these so clearly might invite criticism that proposing these values is moralising. It is for this reason, for instance, that von Foerster avoids such direct remarks. I offer two qualifications. Firstly, that these follow, ultimately, only from an undecidable choice and so they are something to be opted into rather than conformed to. Secondly, they are not a moral code of how to act but rather practical ways of acting which make it possible to take responsibility for however one chooses to act.

account of that here) as well as to the articulation of even such a position as ethical nihilism. That is, even to reject all morality as arbitrary, if done explicitly, is a form of moralisation in that it makes claims on others. This occurs because of the self-reference of the statement (that it is not just about ethics but itself involves ethics) which leads to ethical questions about ethics itself.[85]

Von Foerster (1990/2003, p. 291) proposes that we refrain from articulating ethics at all and instead keep it implicit in our action and discourse; that is, we practice ethics rather than theorising about it (Bröcker, 2003; von Foerster & Poerksen, 2002, pp. 147-148).[86] The most obvious interpretation of this is to avoid speaking about ethics at all. Yet in many situations it is difficult if not impossible to maintain this attitude. One of these is the special case of discussing the subject of ethics (including discussing the idea of refraining from discussing ethics), in doing which von Foerster nevertheless manages to largely remain implicit and with which, in composing the sentences of this section, I am currently struggling. As well as this, many of the ethical questions we commonly encounter need to be discussed with others because of their involvement in the situation or in order to clarify what is at stake and it is hard to do this without raising the questions explicitly. There are also some situations, such as for instance designing architecture, where, because they involve acting in ways that impact ethically on others, one cannot avoid making ethical ideas explicit because even to refrain from doing so is to explicitly take such a position.[87] In this and similar situations, one

---

[85] The account that I give of von Foerster's position regarding ethics stresses his distinction between morals and ethics and the idea that ethics cannot be articulated (von Foerster, 1991, 1990/2003). His other particularly notable remarks on ethics are his (1973/2003) equation of reality with community leading to his often quoted two imperatives: "*The ethical imperative*: Act always so as to increase the number of choices. *The aesthetical imperative*: If you desire to see, learn how to act" (p. 227). See also Glanville (2005). While these ideas can both be integrated into my account and related to design, I have not done so as I find their formulation as imperatives easy to misinterpret (see similarly von Foerster's own comments, von Foerster & Poerksen, 2002, p. 37).

[86] Thus for von Foerster, as it was for Aristotle in the *Nicomachean Ethics*, ethics is a practical matter rather than just a theoretical one.

[87] That is, a building is always an articulation of an ethos and so ethics (Harries, 1975, 1987, 1997). This is most explicit where architecture claims some sort of moral mission (such as for instance Pugin's (1836) *Contrasts* or Le Corbusier's

cannot act without doing so explicitly and to not act is to not make a decision and so to avoid responsibility. Neither does such reticence always escape articulating ethics as even not acting is an action that impacts on others.[88] One way of avoiding this reticence while still avoiding moralisation is to qualify our ethical statements as personal opinion (that is, as our own responsibility; as not making a claim on others). Von Foerster does this where he cannot avoid speaking about ethics, such as where he needs to explain his own position, and proposes that we generally qualify our statements with "I think…" rather than "it is…" (von Foerster & Poerksen, 2002, pp. 27, 37, 40). Yet while qualifying one's opinions in this way avoids the most obvious forms of moralising, it can also sometimes assume its own form of certainty and so moralisation. This is the sort of certainty that follows from relativism. If one understands ethics as a matter of personal preference, whatever one decides to be ethically good will be so, such that one can never be in the wrong (unless one chooses to be). This becomes a form of disconnection from the world and from others (who one excludes by this from questioning one's opinion) and therefore one avoids responsibility by claiming it entirely as one's own. Nor does personalising ethics necessarily avoid moralisation as there is still an implicit claim on others in even a personal statement. If I explicitly articulate what I believe to be ethical, given that I am in a similar situation to others, my claim that such and such is good for me rebounds onto others even if I do not mean it to.[89]

Therefore, while avoiding speaking explicitly about ethics and qualifying what ethical statements we do make as being our opinions helps us to avoid moralising, these strategies do not work in all circumstances. There are situations, such as designing architecture, where these attitudes cannot be maintained or where they exclude others or ignore one's responsibility to act. Given that the origins of the idea that ethics cannot be articulated are in that it cannot be summarised in a

---

(1925/1987, pp. 188-192) concern with the apparently "moral" quality of whitewash) but it is present to some degree in every act of building.

[88] See for instance the example Kierkegaard (1843/1944b, pp. 138-139) gives of the ship captain who, failing to be decisive about which course to steer, is blown somewhere by the wind in any case and can no longer choose.

[89] That is, to explicitly make an "I should…" claim can often still be to make a form of "you should…" claim. Where we address only what we should do, we usually do not need to articulate this but just act it out.

moral code, it is not surprising that there is no simple way of accomplishing this in every circumstance—the choice of how to navigate such dilemmas therefore remains with us. Von Foerster (1990/2003, pp. 291-297) does however make two suggestions for how we can keep our ethics implicit that go beyond the unsatisfactory strategies of avoiding the subject or treating it as a personal matter. The first is that we recognise the undecidability of our decisions, and so where our responsibility lies; the second, that we engage actively with others in dialogue.[90] These two suggestions coincide with the two themes that I highlighted above, that of our personal responsibility and of our participation with others. They are not to be taken as moral rules but rather as practical strategies for keeping ethics implicit.

1.2.2.3 Ethical themes in the epistemology of cybernetics (1): Undecidability and responsibility

The first of the two suggestions made by von Foerster (1990/2003, pp. 291-295) for allowing ethics to remain implicit, is that of undecidability. A decidable question is one which has an unambiguous answer or set of answers. Von Foerster (1990/2003, p. 291) uses the example of a simple problem in arithmetic—"is the number 3,396,714 divisible by 2?" (p. 291). Decidable questions such as this are already decided for us by the framework in which they are asked and it is therefore "only *those* questions that are in principle undecidable, *we* can decide" (1991, p. 64; 1990/2003, p. 293).[91] Von Foerster (1990/2003, p. 292) refers to the origins of the universe as an example of an undecidable question. As there was no-one there to watch it, it cannot be definitively settled, as is evidenced by the many different answers given to this question.[92] Undecidable

---

[90] Von Foerster (1990/2003) refers to these as respectively "metaphysics" and "dialogics" (p. 291). Undecidability is referred to as metaphysics because metaphysics is, according to von Foerster (1990/2003, p. 291), what we are doing when we decide upon in principle undecidable questions.

[91] I've followed the emphasis as per von Foerster (1991). Von Foerster (1990/2003) emphasises only "we" and not also "those" although the (1990/1992) version of the same article emphasises both. This is also sometimes quoted as "only *we* can decide the undecidable" (for instance A. Müller & Müller, 2007, p. 364). This is a compatible and perhaps more interesting variation putting the emphasis on us to make such decisions rather than on the decisions themselves and so, although it does not appear in this form in the texts to which it is cited, it carries von Foerster's meaning well.

[92] See also Medawar's (1984/1986) account of questions which are unanswerable by science.

questions such as this, because they are not already decided for us, are ours to decide how to decide. As von Foerster (1990/2003) writes: “we are under no compulsion, not even under that of logic, when we decide upon in principle undecidable questions. There is no external necessity that forces us to answer such questions one way or another. We are free!” (p. 293).

The freedom of undecidability equates with responsibility and by considering the decidability of a question we can identify where our responsibility and freedom lie. We are responsible for our undecidable decisions in a way that we are not for our decidable ones. We have no choice over, and therefore do not have responsibility for, the answer to a decidable question (as opposed to the giving of that answer); it is only a matter of following through the question’s own logic. By contrast I am fully responsible for the way I decide an undecidable decision, and for its consequences, because the answer is determined by me rather than by the question and its context. I am responsible for how I understand the origins of the universe in a way that I am not responsible for the answer to a question in arithmetic. The undecidability of a question is not an invitation to leave it undecided but rather to decide it. The answers to undecidable decisions still matter; it is just that we do not have the comfort of an answer already provided for us. Each choice is possible but in choosing we are responsible for the consequences of that choice and so for the kind of world we construct.

While it at first seems that we could divide all questions between decidable and undecidable decisions, and so between those we are responsible for and those we are not, this does not follow. While von Foerster (1990/2003, p. 294) avoids qualifying all questions as being undecidable there is a sense in which undecidability cannot be escaped even in a decidable question. This is because the decidability of a question is not a property of the content of the question itself but of the way that question is framed and contextualised. Some questions may be either decidable or undecidable depending on how and where they are asked and by altering the context of a question it is possible to make an undecidable question decidable and vice versa. To show the ambiguity of a question’s decidability I offer two examples—the first, a decidable question in geometry and, the second, an undecidable question of personal preference—and show how the addition or removal of a piece of context changes their decidability.

One straightforward example of a decidable question is that of the sum of the interior angles of a triangle; the answer is unambiguously 180 degrees. However this answer assumes the context of Euclidian geometry. In the context of non-Euclidian elliptical or hyperbolic geometries, which dispute the parallel postulate, the interior angles of a triangle will be respectively greater or less than 180 degrees. In everyday situations we tend to assume a Euclidian context without it being stated. This convention makes the question decidable even though in itself, because it does not qualify its context fully, it is not. If which geometrical system the question is posed in is ambiguous then the question becomes undecidable in that it has more than one possible answer. Similarly an undecidable question might be made to be decidable by some additional piece of context or by some other undecidable decision. The example of deciding which colour shirt to wear is an undecidable question and one that I am free to choose, although one may well disagree with my taste. However the question might be made decidable by a change in the context such as if I was choosing a shirt for a particular event which had a dress code specifying, say, that I wear a white shirt.[93] If I then turn up at the event in a shirt of another colour then I will be in the wrong according to this dress code. If I forgot about the dress code, if I misunderstood it, if I don't have a white shirt or if all my white shirts were in the wash, then I am in error. This is analogous to making a mistake in arithmetic—there was a right course of action given the context that I failed to take through a lack of concentration or disorganisation. However if I disregard the dress code and attend wearing a blue shirt, perhaps in order to make a scene, my "error" is of a quite different order: although I am still wrong according to the dress code, I have chosen to be.

In both the examples of geometry and of a dress code, the decidability rests on conventions which can be disputed and so made undecidable if we so wish. The decidability of a question, and so whether or not it has a right answer, rests on its context. There is therefore a sense in which any decidable question can be made to be undecidable and vice versa by either adding to or disputing

[93] This still doesn't determine the whole action (which particular shirt I will wear) but rather the constraints on what actions are viable. Accepting the dress code, it becomes decidable that I choose a white shirt. Within the class of shirts that are white, the choice is still undecidable.

what is assumed in its context. The question therefore is not whether a decision is or is not decidable but what is implied by making it so and whether this is something we want to do.[94] As this is in itself an undecidable question, we are ultimately responsible for the decidability of decisions and therefore for decidable decisions as well as undecidable ones. There is no shortage of would-be authorities, doctrines or principles that we can refer to that would make difficult decisions decidable for us. This is especially so in both the fields of architecture and of ethics where a variety of theories compete and have competed with each other for our allegiance. But to refer to any of these is to choose to—to decide to make an undecidable decision decidable in these terms—and responsibility (and freedom) ultimately remains with us. Even if we claim the objective priority of some particular principle it is still us that must claim this.

1.2.2.4 Ethical themes in the epistemology of cybernetics (2): Interdependence and dialogue

The second of von Foerster's (1990/2003, pp. 295-297) suggestions for how ethics can remain implicit is dialogue. Whereas undecidability is concerned with the first of the two ethical themes of second-order cybernetics noted above, that of our personal responsibility, dialogue is an instance of the second, that of the participation with others which is implicit in circularity. These two themes might be seen as sometimes being in conflict. To avoid imposing one's own position on others is sometimes to avoid taking responsibility and to act on behalf of someone else is sometimes to impose onto them. The significance of understanding responsibility and dialogue in terms of second-order cybernetics is, however, that instead of being in conflict they become complementary and even imply each other. The idea that we are ultimately personally responsible is often understood as following from the isolation of our individual subjectivity, as for instance by Sartre or Kierkegaard.[95] Instead, second-order cybernetics understands our responsibility to follow from our interdependence with the world rather than our separation from it. By establishing its critique of

---

[94] As von Foerster (1990/2003) puts it, "we can choose who we wish to become when we have decided on an in principle undecidable question" (p. 293).

[95] See for instance MacIntyre's (1981/1985) criticisms of Sartre (pp. 23-35, 204-225), Kierkegaard (pp. 39-52) and existentialism generally (MacIntyre, 1967). On MacIntyre's challenge to Kierkegaard, see also Davenport and Rudd (2001).

objectivity in this way, second-order cybernetics not only criticises objectivity as something we are subjectively responsible for but simultaneously undermines subjectivity in the same terms as being disconnected from the world.[96]

Understanding epistemology in terms of circularity, our individual responsibility is bound together with our participation with others.[97] As von Foerster (1991) puts it, we "see ourselves through the eyes of the other" (p. 73). We understand the significance of our own actions for others by understanding how they understand us.[98] In this, epistemological and ethical questions coincide with each other—it is the same activity to understand one's own action as to understand one's relation with others. This complementary aspect of these themes is implicit in the idea of circularity and feedback itself (which is not surprising since it is from this that they have followed). In order to act I need to listen and in order to listen I need to act as there can be no feedback or circularity unless I both act and observe and so both action and observation are dependent on each other.[99] This returns us to the epistemology of cybernetics understood as something in which personal responsibility and participation are implicit, and thus an approach that satisfies von Foerster's invocation to us to avoid articulating ethics.

---

[96] While von Foerster (1979/2003, p. 285) is equally critical of subjectivity as objectivity and also (1973/2003, pp. 226-227; 2002, pp. 26-30) dismisses solipsism, his criticisms of objectivity are much more fully developed. It seems to me that the great significance of second-order cybernetics is that the same criticisms can be made of both subjectivity and objectivity rather than by using one to critique the other.

[97] Von Foerster (1990/2003, pp. 296-297) uses the metaphor of a dance with others (see also Waters, 1999) to describe the reflexive nature of this interconnection.

[98] This is the basis of Pask's (1976) conversation theory which I have described below.

[99] This is one way of interpreting Wittgenstein's (1921/1974) statement that "ethics and aesthetics are one and the same" (6.421). This follows almost immediately after the statement to which von Foerster (1990/2003, p. 290) refers, "that ethics cannot be articulated" (also within point 6.421; von Foerster's translation). It also resonates with Maxwell's point that "the only laws of matter are those which our minds must fabricate, and the only laws of mind are fabricated for it by matter" (Campbell & Garnett, 1882, p. 244).

1.2.3 Cybernetics and design

1.2.3.1 Cybernetics, design and conversation

While cybernetics has often been associated with design (Pask, 1969, 1975a; Simon, 1969/1996, pp. 169-174; see also Spiller, 2006), more recently the connections between the two have been explored in more depth (for instance Dubberly & Pangaro, 2007; Gage, 2006, 2007b, 2007c; Glanville, 2007b, 2007e, 2009b; Glanville & Sweeting, 2011; Jachna, 2011; Jonas, 2007b, 2012; Krippendorff, 2006, 2007a; Krueger, 2007; Pangaro, 2008; Pearce & Spiller, 1995; Rawes, 2007; Spiller, 1998a, 1998b, 2002). One way of establishing this connection is in terms of the conversational nature of designing, as manifest in activities such as sketching and the conversations which designers hold with others as well as in the epistemological structure of the process as a whole which these activities support. Conversation is widely appealed to as an analogy in design research—for instance by Cross (2007a, p. 58), Gedenryd (1998), Glanville (2007e), Goldschmidt (1991) and, most significantly, by Schön (1983/1991) who characterises design (and also a similarly reflective approach in other contexts) as a "reflective conversation with the situation" (p. 76). In second-order cybernetics, conversation, in the sense of Pask's (1976) conversation theory, is one key paradigm of circularity and feedback. Understanding design in terms of conversation creates a symmetrical analogy between design and the epistemology of cybernetics to the extent that Glanville (2007e) even claims that "cybernetics is the theory of design and design is the action of cybernetics" (p. 1178). Thus, design is not just similar to cybernetics and conversation but cybernetics and conversation are also similar to designing.

1.2.3.2 Conversation theory

Conversation theory is an account of circularity in cybernetics, developed by Pask in the context of education but also applicable in terms of communication and epistemology (Pask, 1972, 1975a, 1975b, 1975c, 1976; Pask, et al., 1975; Pask & Scott, 1973; Pask, et al., 1973). It is a distinctly second-order theory both in the sense of its inclusion of the observer in the circularity of conversation and also in reflecting onto itself—being a "theory of theory building" (Pask, 1969/1970, p. 39), the development of conversation theory was also an instance of its practice (Scott, 2007, p.

39-40).[100] The account I give here is much simplified compared to Pask's own but is sufficient in order to make the analogy with design (see also Barnes, 2007; Dubberly & Pangaro, 2009; Glanville, 1993, 2002b, 2007d; 2007e, pp. 1185-1186; Glanville & Müller, 2007; Pangaro, 1993; Scott, 1993, 2001, 2007, 2011).

It is a premise of conversation theory that meaning cannot be directly transferred from one participant in a conversation to another but must be constructed separately by each individual. This is equivalent to the premise of radical constructivism and second-order cybernetics, which I introduced above, that we cannot remove ourselves from the act of observation and so cannot understand our understanding in terms of a correspondence with the world.[101] That is, in a conversation, we cannot understand our understanding as corresponding to that of another but rather must build our own understanding of their understanding. Each participant's understanding will therefore be different from those of others, even when referred to using the same terminology and where in agreement (Barnes, 2007, p. 76). Conversation theory accounts for how, given this difference, we can still communicate with each other as we evidently are able to do. In the simplest case of a conversation between two participants, I might begin by making a presentation of some idea which I wish to share. Given that I cannot transfer this idea to the other participant, they instead try to build their own understanding of what it is that I mean and then present what they have understood back to me. Again, I can't simply have this understanding transferred to me and I must construct my own understanding of their presentation of what they have understood. A conversation therefore takes the recursive form "what I think of what you think I think, etc." (Glanville, 1993, p. 217). If these two meanings (what I meant to communicate; what I understand

[100] In comparison with other notable theories of circularity in second-order cybernetics—such as autopoiesis (Varela, et al., 1974), von Foerster's (1976/2003) eigen-forms and Glanville's (1975) objects—conversation theory is, despite the complex nature of Pask's terminology and presentation, relatively easily accessible as conversation is something we are all familiar with from our everyday interactions with others.

[101] Although Conversation Theory has many similarities with radical constructivism (Scott, 2001), Pask's own approach is not radically constructivist as he tends to still assume at least the possibility of a correct understanding of the world in contrast to our incomplete understandings (Glanville, 2007a, p. 20).

the other to have understood) are close then I can be satisfied that I have been understood well enough. If they are divergent I can offer further clarification or perhaps explain my point in a different way and again compare what I mean to say to what I understand has been understood. We can repeat this circular process as many times as we wish in order to try to bring the two meanings closer together although we can also abandon it either through frustration or, alternatively, through the agreement to disagree (Pask, 1988, p. 85). In this way conversation is a continual feedback process which allows participants to align their understandings stably with those of each other while (and despite) each of their understandings being essentially individual constructions.

This is not, however, merely a way of communicating some already established meaning, such as one participant trying to adopt the understanding of the other such as with a code.[102] Rather each participant is continually revising their understanding and so, while conversation is concerned with stability, this is in a distinctly dynamic sense.[103] Conversation has an intrinsic tendency towards the generation of new meanings because, given that meaning cannot be directly transferred, it involves constructing new understandings at every turn. Conversation, even in the everyday sense, is therefore an epistemological activity and the epistemology of cybernetics and radical constructivism, especially the idea of viability, can be thought of in terms of conversation. Another aspect of a conversation's intrinsically generative nature is that it always involves an interaction with others through which we can develop our understanding both of the topic but also of the other participants (Barnes, 2007, p. 81). This is most clearly seen in the way we learn from the ideas which others present to us and from their comments on and criticisms of our own thoughts which prompt us to revise our thinking. We also sometimes learn even through misunderstanding, where we see a worthwhile idea in what someone says that was not intended. Perhaps most simply, we learn what is implied by our own ideas just by seeing how they are interpreted and understood by others. This latter aspect is an example of the general case of circularity and feedback where we take (our understanding of) the effects of an action as an input to guide our further action.

---

[102] See also Glanville (1996).

[103] On the idea that stability is dynamic see also Pask (1961, pp. 11-12, 18).

1.2.3.3 Design and conversation

The activity of designing is, similarly to a conversation, a circular process of feedback. While this can be seen to work at different scales throughout design, it is particularly evident in sketching where the feedback is most immediate (for instance Figure 1, Figure 2). In sketching the designer simultaneously plays role of speaker and listener, switching roles between the two.[104] Goldschmidt (1991) has called this process "the dialectics of sketching" but, understood cybernetically, it is better understood as a dialogue rather than dialectic, in that it is potentially endless. With the case of sketching this process occurs continually, with the designer evaluating and drawing at the same time.[105] This process is also present in the more long term tasks of the design process, such as developing different iterations of a scheme, but in a more clearly sequential manner. Similarly to a conversation, the circularity of design enables both the pursuit of stability and also the generation of new ideas and goals. In sketching, the designer needs to continually invent new understandings at every turn (continually constructing possible ways of interpreting the sketch), receives feedback about an idea through its exploration (in the same way that we learn from others) and finds new ideas in a drawing even when not intended (in the same way that in a conversation a misunderstanding can sometimes offer new possibilities). While in one sense the feedback process of sketching allows us to pursue some idea, as with conversation, this idea is not fixed at the outset but is developed through the process. In trying to achieve some idea, we revise not just the attempt to fulfil it but also the idea itself, having learnt more about it and the situation, just as the nature and content of a conversation changes during its course (that is, the goal of our action moves with

[104] Pask's Conversation Theory allowed for the sort of conversation one might have with oneself—each participant in the conversation (p-individual) does not necessarily correspond directly to a particular person or machine (the m-individual in which the p-individual is embodied). There may be more than one p-individual in any given m-individual and many m-individuals may constitute one p-individual.

[105] It is for this reason that sketching is the most prominent example used by Gedenryd (1998), Glanville (2006a, 2006b, 2007e, 2009b) and Schön (1983/1991) in describing design in terms of conversation.

our action). Designers in this sense do not solve problems but invent them, exploring the situation through making proposals.[106]

The significance of this conversational epistemology is that it enables designers to act in the ill-defined or otherwise complex situations that they typically encounter, where objective methods of problem solving are ineffective, and to do so without being merely arbitrary. This can be thought of in terms of the ideas of undecidability and viability I have introduced above. The situations that designers encounter are undecidable in that they do not have definite right answers (even objective criteria cannot be invoked objectively and the requirements that are given in a design brief are typically incomplete or contradictory) and what they propose is therefore a matter for them to choose. However, similar to the role of viability in radical constructivism, while the designer's choice is undecidable, it must be one that is viable and so is not merely a matter of preference.[107] This viability applies to design not just in the sense of functional or technical criteria (that something has to work in a particular way in order to be what it is to be) but also in other senses such as whether something can be understood in some way or in terms of any other goals of the designers or other stakeholders, including their personal ones. While some of the criteria that must be met for something to be viable will be obvious, it is not possible to state all such criteria in advance. This is partly because in trying to design something one finds new ways in which possibilities are unviable (just as in epistemology, an understanding can become unviable through new experience) but also because new goals become possible as one designs and, if chosen, lead to new criteria. Thus while the criterion of viability is not a matter of personal preference it is still a matter of choice rather than

---

[106] Lawson's (1979) studies show how in problem solving situations designers focus on proposing potential solutions rather than, as scientists, on analysing the problem. Designers explore the situation through making proposals. (See also Cross, 2007a, pp. 36-37).

[107] Similarly to the analogy von Glasersfeld draws between constructivism and evolution, the requirements of viability do not determine a proposal but reject ones that are unviable. Bateson describes thinking and evolution as stochastic processes (1979/1985, p. 160; 1972/2000, p. 255) in that they combine together arbitrariness with reasoned choice. That design in this sense has a similar structure to evolution is an interesting twist on the contemporary debates over creationism or "intelligent design". On design and evolution, see also Frazer (1995).

an objective property of the situation: we choose and are responsible for what we try to do and so for the requirements of viability that follow from this. While it is perhaps more natural to speak about undecidable decisions within the constraints of what is viable, there is also a sense in which design is the invention of new ways in which something can be understood as being viable (that is, the invention of the identity of an object in response to its qualities rather than the choice of its qualities in terms of its identity).

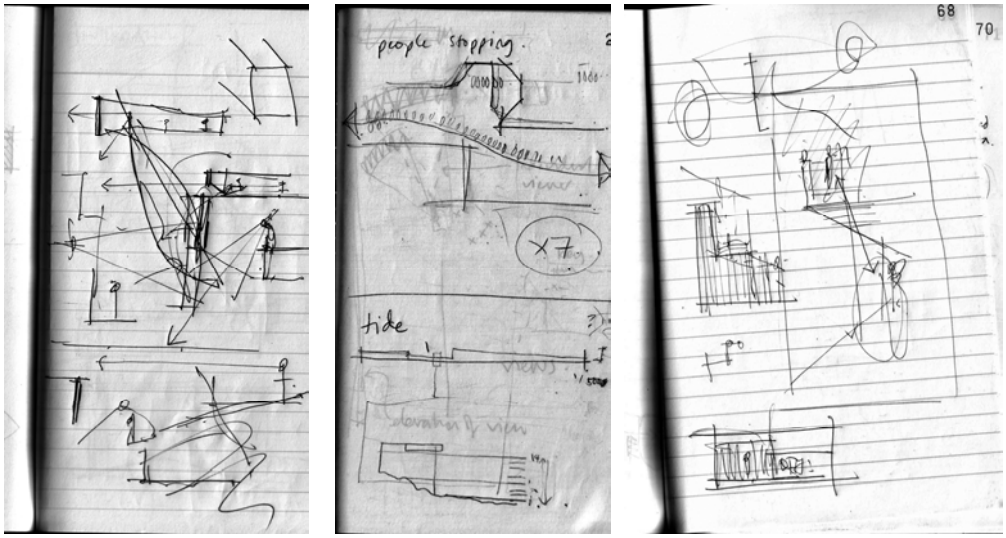

Figure 1: Some sketches from teaching design.
These are not the sort of sketches that represent an idea and, even remembering the projects, I struggle to interpret them. They, however, make sense while one is drawing them. In sketching while one talks with a student one is not simply helping them with a question but demonstrating a technique of thinking (through drawing) for them.

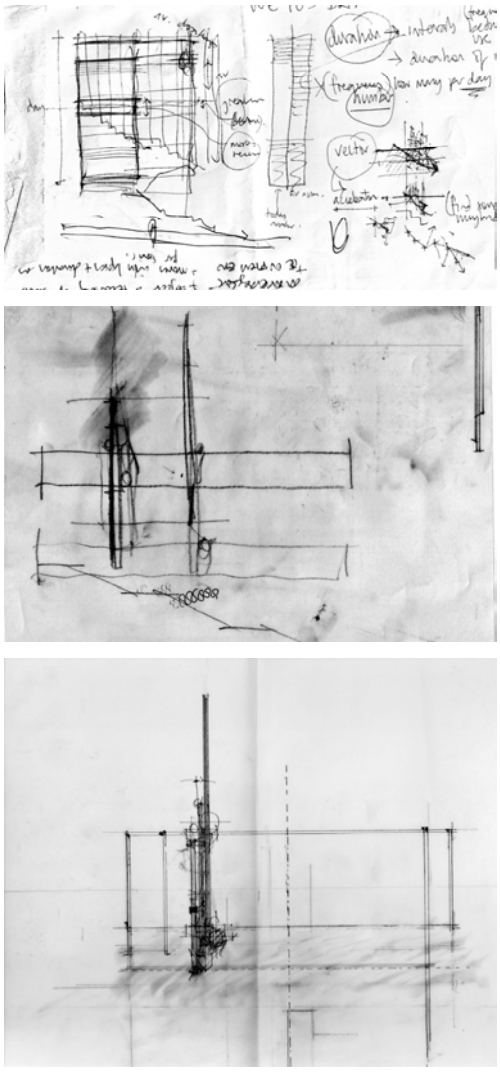

Figure 2: Sketches for St. Alphage Gardens project.

1.3 Starting points (2): The contingencies of objects

1.3.1 Architecture and contingency

The second of the two starting points that I introduce here is that of the contingencies and tolerances of the objects we design. Architecture, as Till (2007, 2009) describes, is a contingent discipline. It is never the exclusive preserve of its designers but always involves a complex variety of stakeholders and other factors both within the design process and in the life of a building after completion and, as Krippendorff (2006, pp. 63-65; 2007a, p. 1388) points out, even the idea of the user is an oversimplification of a variety of stakeholders. This contingency is both a manifestation of the epistemological and ethical undecidability of architecture (there being no decidable design solution, there are a variety of viable contingent possibilities) and also the source of that undecidability (architecture being contingent on its various stakeholders, it is too complex to be decidable). Architects have often tried to create order amidst this contingency. While this is most conspicuous in modernism's enjoyment of the clean lines of machines and in dogmas such as form follows function or truth to materials, it is similarly evident in many other approaches to architecture, such as for instance: in the classical tradition which modernism supplanted; in architecture's continual reference to its origins; in the historicist or typological references of post-modernism; in the search for architecture's intrinsic language in terms of structuralism; in the geometrical determinism of computerised form making; in references to "authentic" forms of dwelling; and in the assertion of personal visions which is both feature of contemporary architecture and also dates back to romanticism.

I have always enjoyed those moments where architecture's contingencies, rather than its reasons, become manifest—whether the presence of "rogue" everyday objects (Till, 2009, p. 31); the peculiar adjacencies between elements of cities (e.g. Figure 19) and in ad hoc constructions or the accidental traces left by everyday activities (e.g. Figure 16) and the weather. Some architects

have harnessed such qualities, often through utilising the agency of architecture's users though participation, interactivity or customisation.[108] My interest is however not so much with the agency of the user (or other stakeholders) but rather with the contingencies that follow from the epistemology of designing—that is, the way that everything we design could equally have been different. Even the attempt to rationalise architecture or the design process is a contingent action, depending at some level on an assumption or assertion, even if it must be traced all the way back to our ultimate responsibility for our epistemology (for the undecidable choice between being part of the world or apart from it).

1.3.2 Contingency and viability

My point of departure for this project is the way that even a functional everyday object, with a clearly definable purpose, cannot be determined from the requirements of this purpose. When we consider such things (tables, bath trays, back scrubbers, watches, spades…) there are relatively clear constraints that follow from their identity. For instance, if we are to use something as a table its height and surface will need to be such that we can put things on it.[109] These requirements however are very minimal and leave enormous room for variation both within their constraints and also in terms of other qualities which are not constrained at all.[110] This is manifest in the huge variety of even typical everyday objects.

---

[108] For instance: the interactions and adaptability of Cedric Price (Price, 1984; Spiller, 2002, pp. 84-89; 2006, pp. 48-50, 208); the controlled chaos of Kroll's Medical Faculty Housing; the non-pedigreed architecture highlighted by Rudofsky (1964); the copious pot plants and other place making of Hertzberger's Central Beheer office building; and the recent debates around participation and agency in architectural design.

[109] This is of course not the only aspect of a table, which can also act spatially as a way of organising and orienting space, a role which brings with it other criteria for viability. This is especially the case in a zero gravity environment where a table no longer functions as something to put something on but still plays an important spatial role (see Krueger, 2000). This is one of Vesely's (2004, p. 52) most convincing examples of the importance for us of a horizontal and vertical ordering of space.

[110] MacIntyre (1981/1985, pp. 56-61) uses similar observations about the design of objects as part of his account of social roles and the is-ought question. MacIntyre uses the example of a watch as something where our concept of a watch

This can be understood in terms of viability. There are particular constraints that the object must stay within to be usable or to be understood in a particular way. As with the epistemological idea of viability, this still leaves a variety of possibilities and the situation is therefore undecidable in the sense of involving under-constrained choices between different viable possibilities. As with decidable and undecidable decisions in general, even those aspects of a design question which are decidable can be brought into question as they follow from other under-constrained choices such as what is to be designed and from how we understand the situation in which we make these propositions.[111] Everything is contingent in some sense as even decidability is itself something we are responsible for. The question I have pursued in this project is therefore not how to make things that are contingent but, rather, how to make the contingency of something experienceable. I enjoy the manifestations of contingency and see it as in sympathy with us (the contingency of our objects follows from the contingencies of our purposes) and as a way of acknowledging my agency over the design by expressing my lack of reasons for it.

1.3.3 Contingent geometries

I have pursued two strategies. The first is concerned with the formal characteristics of the objects. I developed an elaborate method of generating geometries through drawing. I have used this in all these drawings (Figure 3-Figure 15) to some extent although I always think mostly of the bath tray plan drawing (Figure 4) as this is its most elaborate manifestation. I began each drawing by

---

implies the idea of a good watch, describing this and other examples as "functional concepts" (p. 58). Understanding this more fully in terms of design (MacIntyre only takes this as an example), while our concept of watch does in a sense imply the concept of a good watch, this needs clarification. What is implied in "good" here is the sense of good enough or viability of being a watch and this leaves many possibilities open for what a watch might be that cannot necessarily be judged commensurably against each other (hence the variety of watches and other time pieces). This observation is beneficial to MacIntyre's argument when it is carried through to social roles (he argues that the concept of a farmer or a sea captain are similarly functional concepts) and to human purpose (he proposes that we also understand ourselves as a functional concept) as it removes the sense that these purposes are deterministic.

[111] As in the famous example of Cedric Price telling a client that "maybe you don't need a new house, maybe you need to leave your wife" (quoted in Steenson, 2010, para. 1).

sketching out a number of different versions of each element drawn over the top of each other. These marks, largely in pencil but sometimes in pen, have mostly been obscured by the later line work. This initial period of sketching was intentionally very gestural although I took account of any particular requirements of the object such as where one element had to connect to another or where particular dimensional constraints needed to be observed (the various constraints of viability). Following these marks I added several repetitive layers of hatching, the precision of which contrasts with the earlier more gestural sketching. This combined the geometries of the different sketched versions together creating a new hybridised version. These layers would amalgamate some forms which had previously been separate and give new weight to previously faint lines, reinterpreting marks in new ways. They would pass over some elements, pushing them back into the depth of the drawing, and under others, bringing them forward. On beginning a layer of hatching I would not be sure what edges I would follow but would decide as I progressed across the page, sometimes in response to how the drawing looked and sometimes just arbitrarily. This process had the effect of creating geometries that I would not have generated had I developed the drawing as one whole.

This process can be described in terms of my earlier account of viability in designing. This is firstly in the sense that the drawings stayed within the broad constraints for the object I was designing to be functionally viable as that object. Sometimes, however, I would begin a drawing without having decided what it was going to be, and so what constraints to apply, and instead decide this while making the drawing or would change my mind about what I was drawing while I was drawing it, such that the constraints on its viability shifted during the process. I became deliberately more ambiguous about this as I continued and the last three drawings of the series (Figure 13-Figure 15), which I regard as amongst the most successful, remain unfinished in the sense that I have never finally decided what function to explain them as performing.

Beyond this functional sense, it is also possible to understand my own aims for the project—that of designing objects which embodied the contingency of my decisions—in terms of viability. In a sense, everything we design is contingent as even to determine a form with reference to some set of authoritative precedents or principles is a contingent act in that these precedents or

principles did not need to be invoked. I therefore have not seen this project as a question of creating arbitrary forms (all forms that I might create being arbitrary in the sense that they could have been otherwise and non-arbitrary in that I have chosen to make them as they are). Instead, I have tried to design the objects so that they looked contingent—that is, that they looked as if they might equally have been otherwise. Whereas, conventionally, one develops some kind of order for what one proposes (that is, a way of making sense of it; see Krippendorff, 1989), I was looking for a configuration that seemed to lack such an order. This is, of course, just a different sort of order and involves viability in the same way in terms of whether such an understanding could be viably constructed about what I proposed (or, rather, whether it was viable for me to imagine someone else viably constructing this interpretation). I have come to see this, reflecting on it now, as searching for compositions which are inefficient to explain (not in the sense of explaining how they were developed or in terms of my ideas about them but in the sense of explaining their order). This is different from compositions which lack any order and which are therefore easily explicable as a whole with no pattern. The geometries of the drawings elude definition in terms of any one ordering or explanatory principle by, for instance, conforming to some regularity or pattern only in part such that these different explanations interfere with each other.

1.3.4 Mechanisms and under-constraint

The second of the two strategies I have followed in this project is that of mechanising elements of the objects so that they could vary automatically between different configurations or move between different positions. This parallels the previous strategy in that the object oscillates between alternative viable possibilities such as those drawn in the initial marks of the drawings.[112] The movements create slight variations of position, alignment or dimension so that each use of the object will be different in some minor way (for instance, the handle of the back scrubber (Figure 6)

[112] This contrast between precision and contingency reverberates at several levels of the project—in the construction of the drawings, in the geometries of the objects, in the contrast between the mechanical and the everyday and also in the way that, when I present these drawings verbally, I tend to present what are unnecessary and impractical objects in straightforward and practical terms.

will be a little longer than it was previously, enabling it to reach a little lower; the gauge of the bath tray will become a little wider so that the small piece of soap will now fall through it…). The adjustments would occur slowly so that, in using something, one's experience would change so gradually that it would not necessarily being noticeable (I have always thought of this rather like the way the movement of the tide is only perceptible over a period of observation). In this way, by using the objects one would experience the under-constrained tolerances of their viability. There is therefore an uncertainty over the configuration of the objects (paralleling that over their geometry) which is evocative of the tolerances of the decisions behind the design.

There is a contrast between the precision of the mechanical components and the contingencies of everyday activities with which the projects are concerned. Architecture is often something of a compromise between different priorities competing for limited spatial and financial resources, with the choices of designers therefore over-constrained. As well as compromises over space there is also a sense in which architecture is a compromise over time—that it must be usable in different ways at different times and so cannot be ideally suited to any particular one of these moments. However, if one considers architecture as capable of changing in response to its use, this apparent over-constraint can also be seen as under-constraint. Even a minimal amount of adaptability, such as that in these projects, can provide more possibilities than there are reasons for adopting. This over-precision is also suggested by their mechanical forms which have tolerances that are much finer than the activities that they have been designed for. In these ways, the overly precise quality of the mechanisms, arbitrarily cycling through various viable configurations which cannot be decided between, makes visible the under-constraint of their design and use.

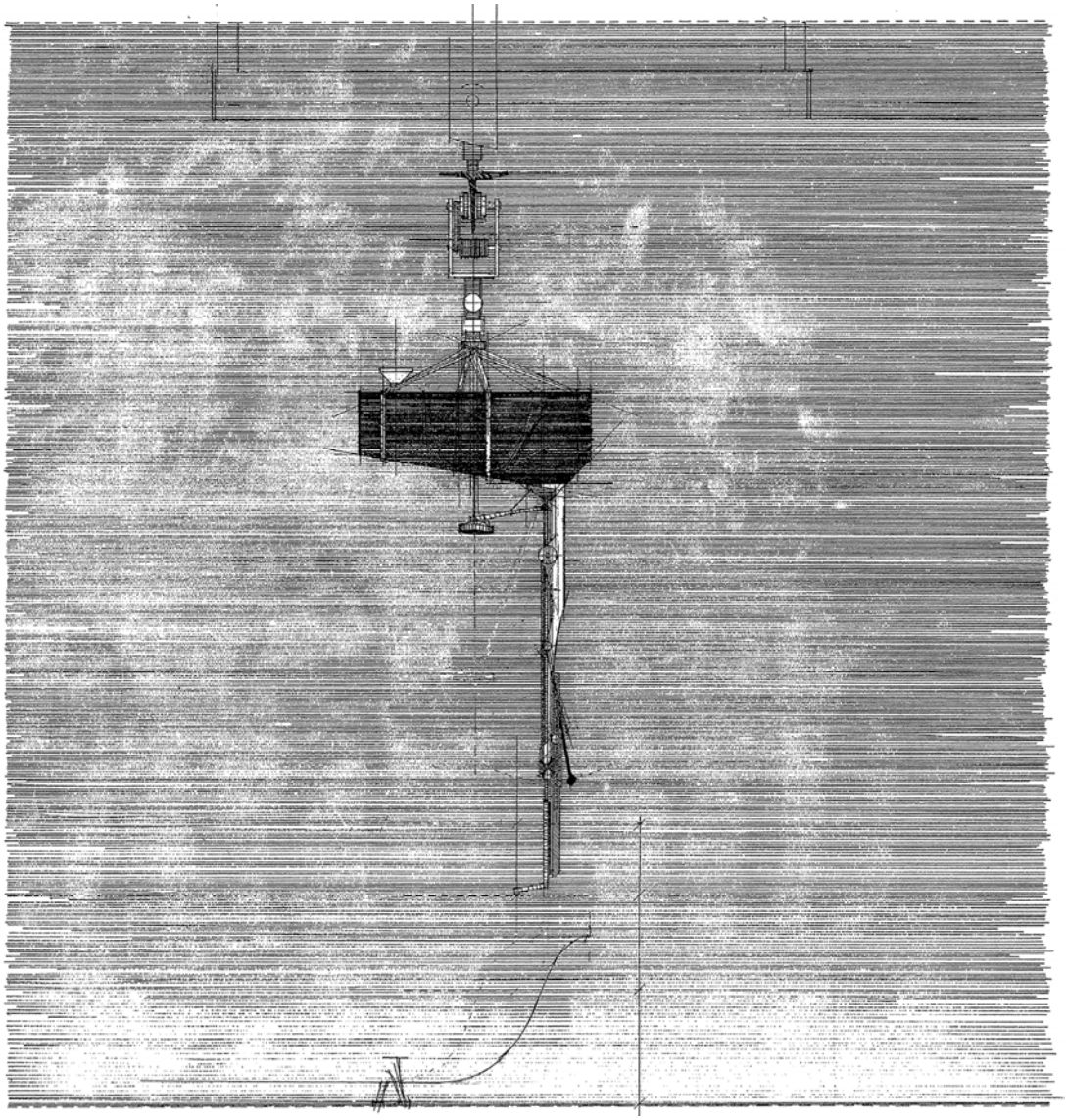

Figure 3: Repositionable plumbing for bathroom, elevation drawing.
Bathrooms are particularly hard to rearrange because of the inertia of plumbing. In this drawing I have imagined a mobile plumbing device, attached to a track in the ceiling, for collecting water, heating it and taking it to wherever the bath happened to be.[113]

[113] The drawings in this section are all made using Rotring drawing pens and pencil on tracing paper. They have been photocopied on a relatively new xerox-type photocopier and then scanned. I consider the photocopying to be part of the work as it interacts with the close hatching in interesting ways dependent on the particular qualities of the machine used.

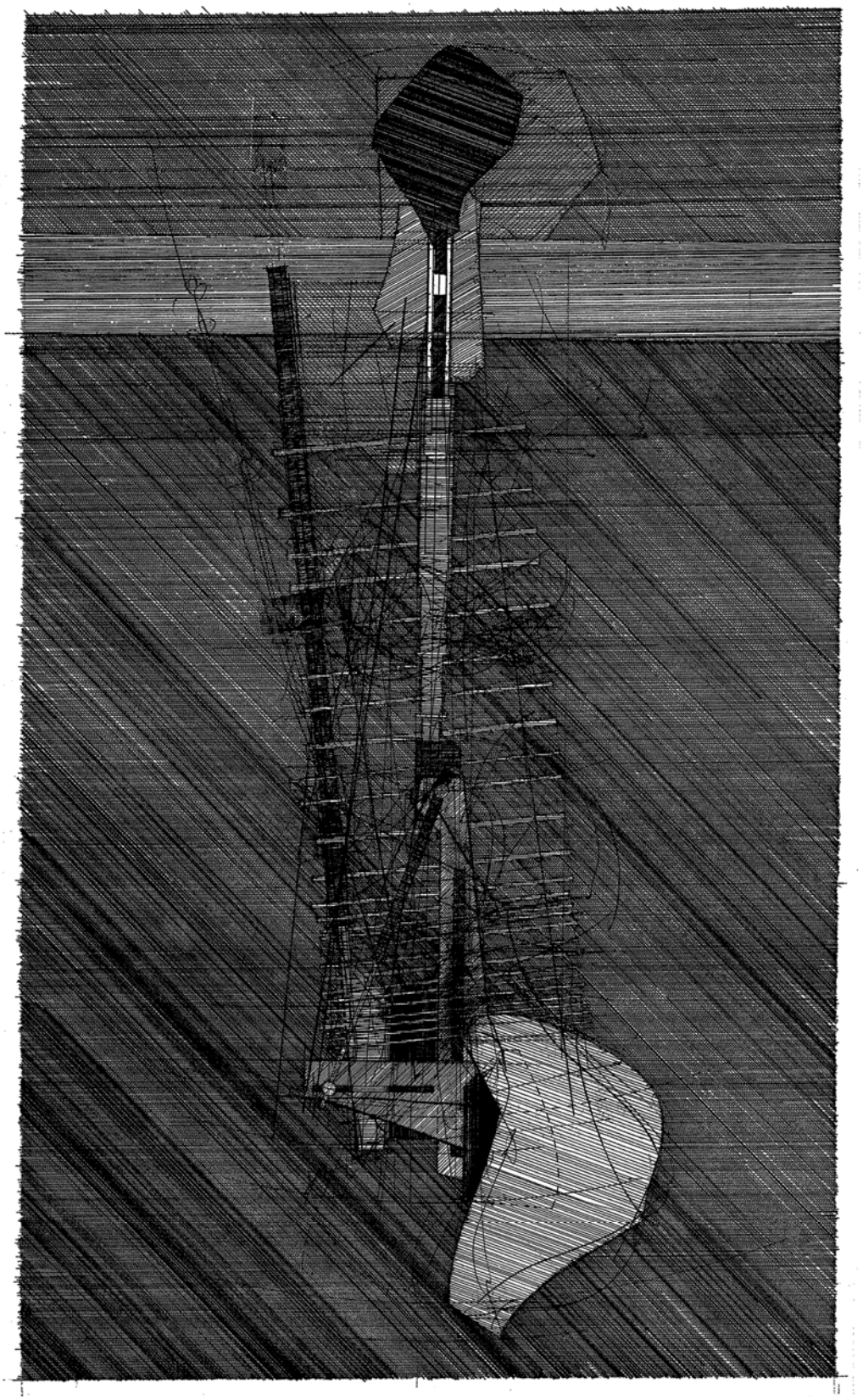

Figure 4: Bath tray, plan drawing.
The bath tray would flex, extend and contract randomly during use, cycling through a variety of slightly different possible configurations and angles (use could be sensed by the increased weight of the bath). At its maximum extensions smaller items would fall through the gaps in the tray. This is also affected by the way that a bar of soap would become smaller over the course of a bath and so fall through gaps of a size at the end of taking a bath that it would not have done beforehand.

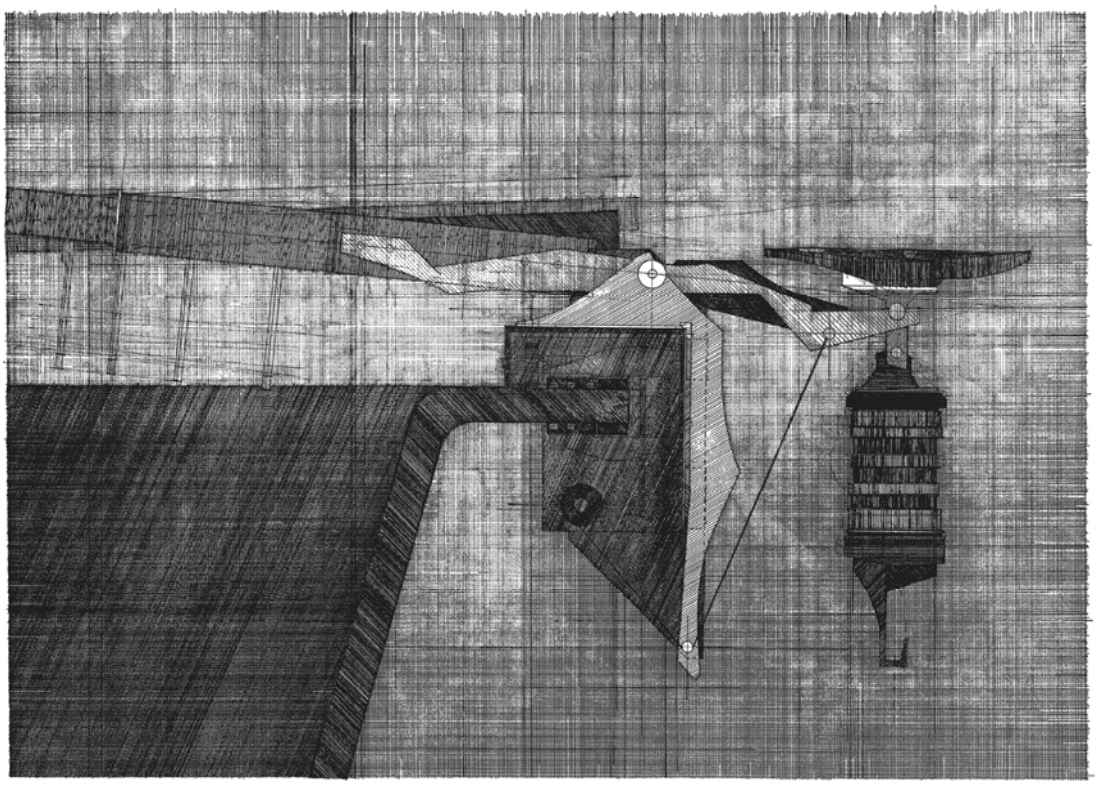

Figure 5: Bath tray, section drawing.

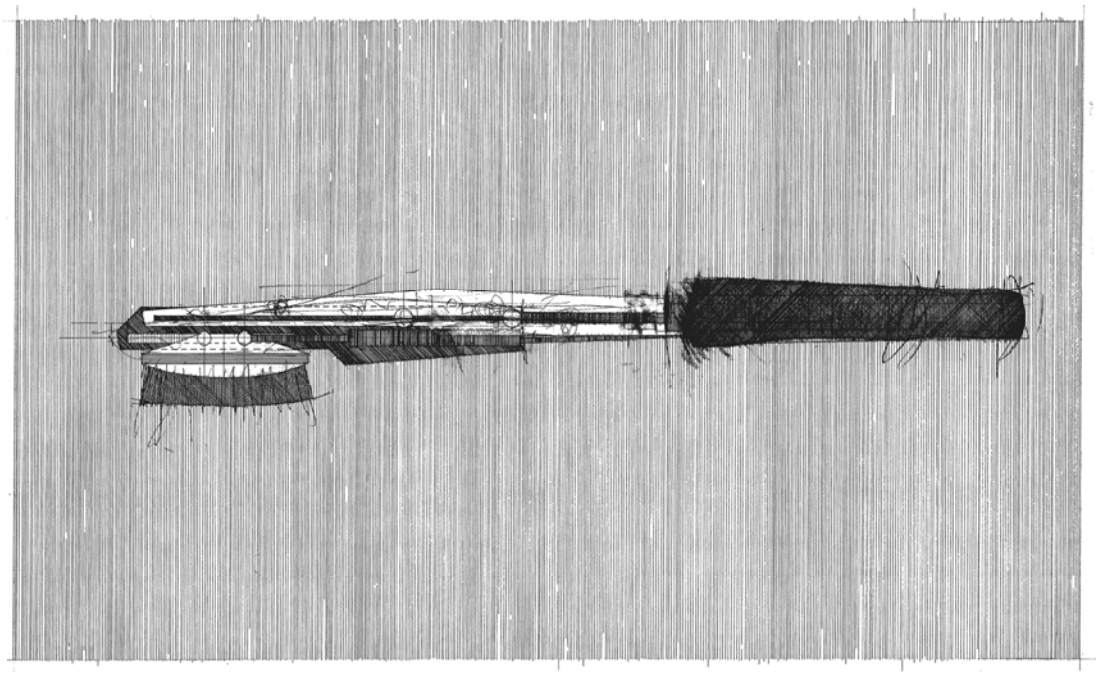

Figure 6: Self-adjusting back scrubber, elevation drawing.
The back scrubber would slowly get longer as it is being used, making it easier to reach the lower back but more difficult to reach higher up. It can be reset to the desired size at any point.

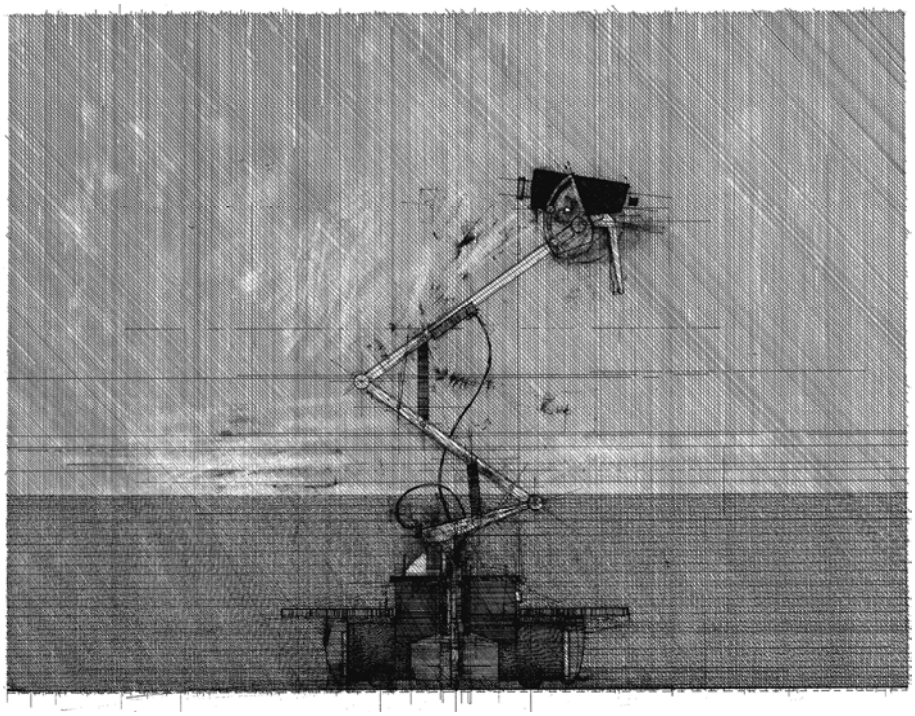

Figure 7: Viewing glasses for promenade, section drawing.
Each use of the machine would cause it to move in a random direction by a few metres so that it slowly promenades along the seafront in an undetermined path, performing what, mathematically, is referred to as a random walk.

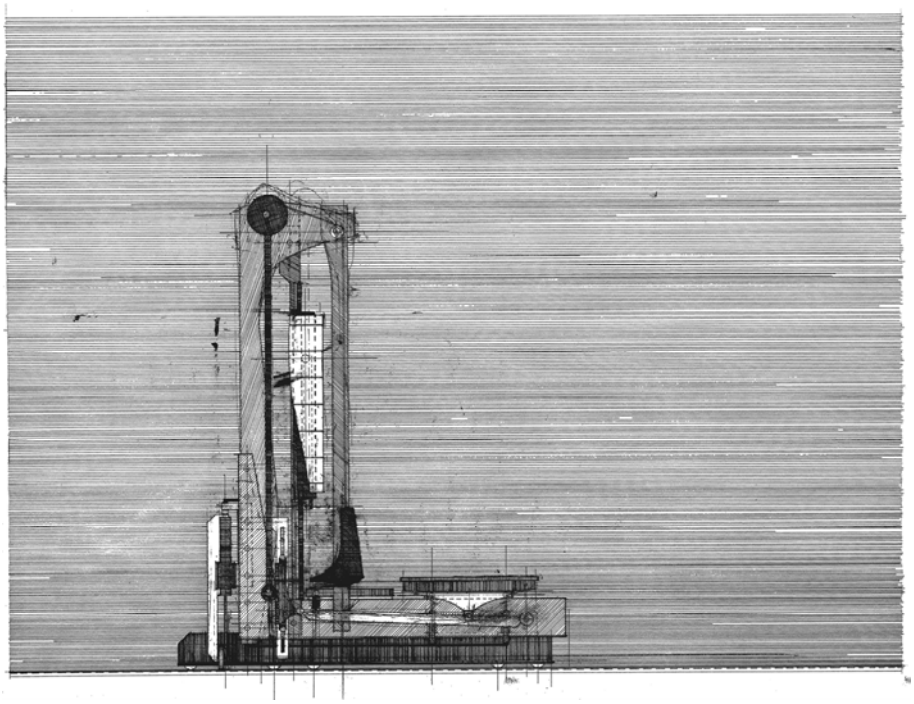

Figure 8: Guess-your-weight machine for promenade, elevation drawing.
Similar to the viewing glasses, each use of this machine would cause it to move such that it promenades itself along the seafront. In addition, each time the machine measures someone's (or something's) weight, it would recalibrate itself displaying the new weight in terms of the average, maximum and minimum weight of everything it has so far measured.

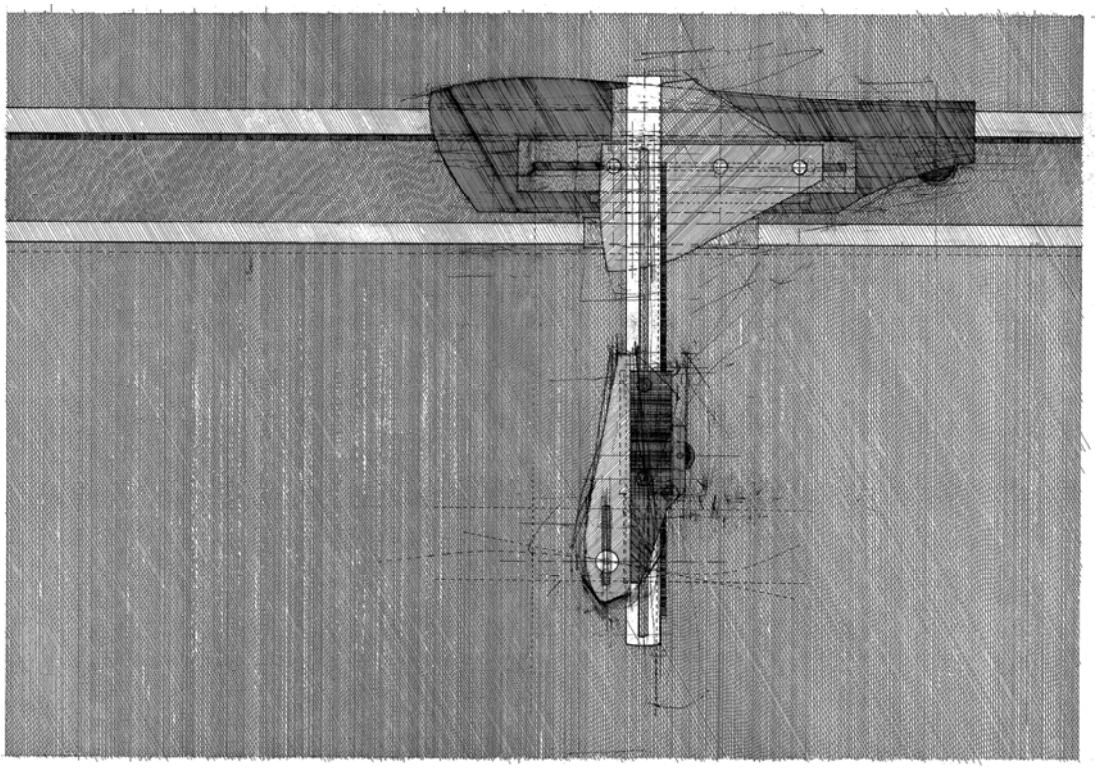

Figure 9: A machine for drawing an uncertain line (1).
This drawing and the one that follows below propose mechanical, repetitious devices which make non-repeatable marks (randomly but within a set of tolerances) by incorporating loose junctions within their mechanisms. The idea of these devices contrasts with the parallel motion with which I have made most of the marks in the drawings. (In proposing machines which bring measurement into juxtaposition with contingency, I had in mind Duchamp's Three Standard Stoppages).

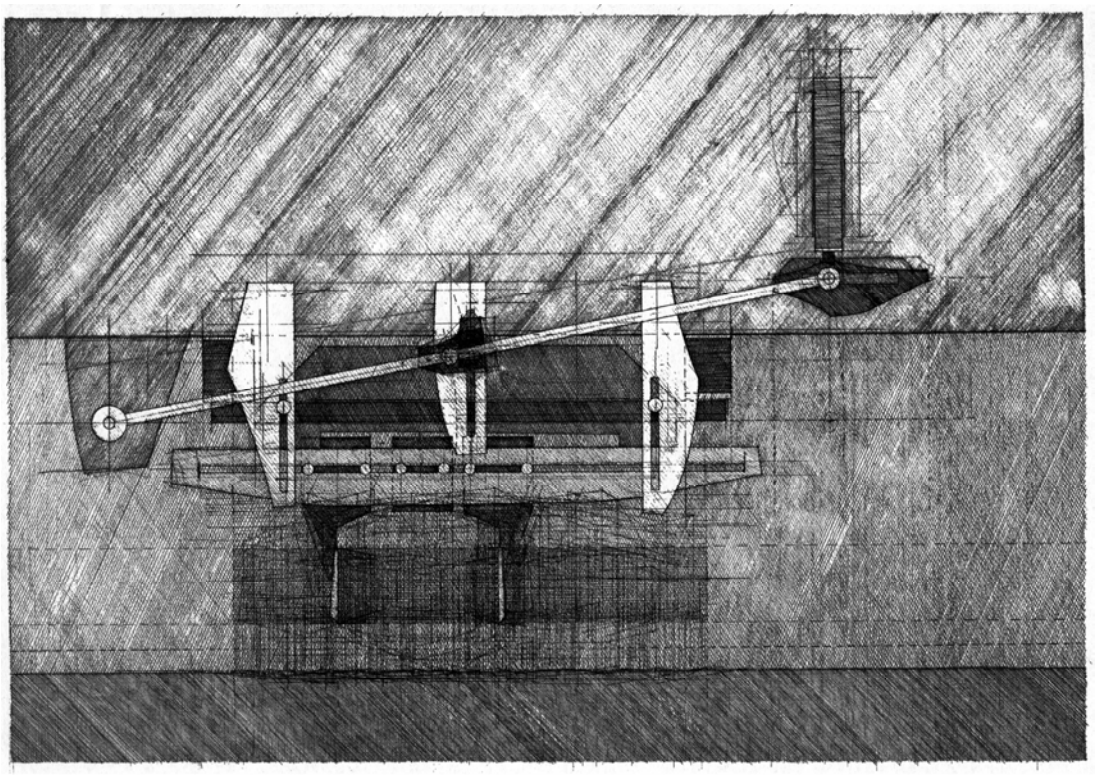

Figure 10: A machine for drawing an uncertain line (2).

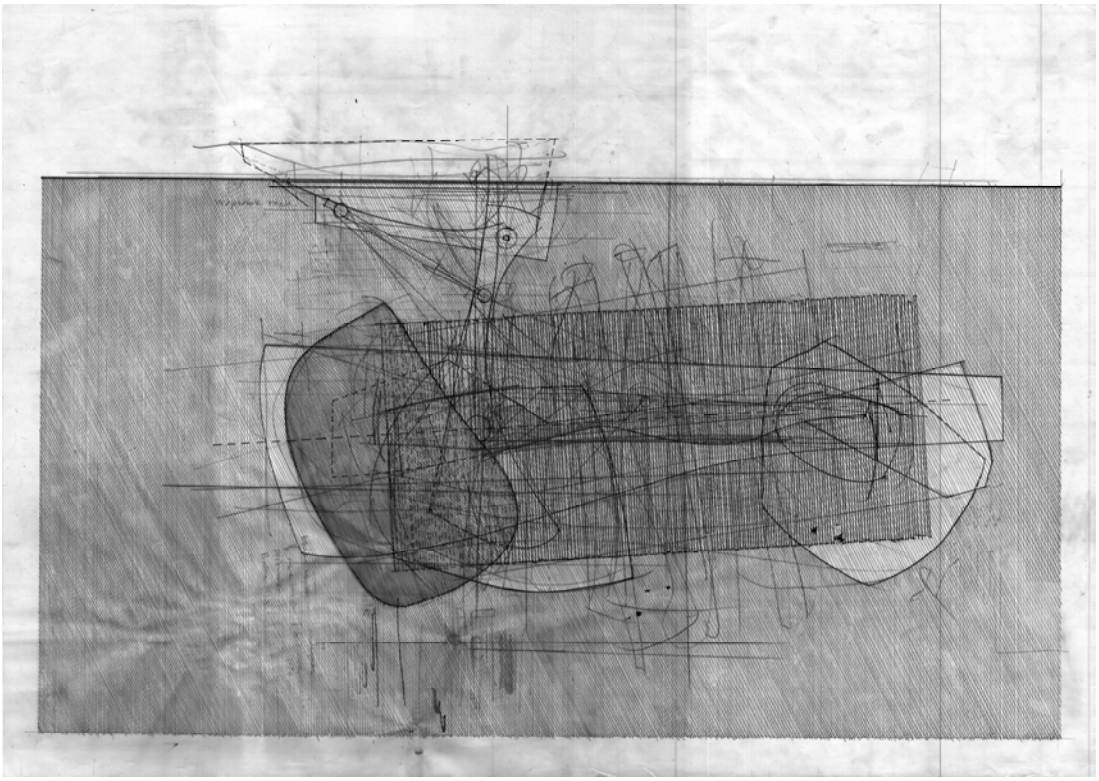

Figure 11: Oscillating vegetable rack, plan drawing.
Similarly to the bath tray, this vegetable rack would cycle through a number of slightly different configurations, expanding and contracting and in so doing causing some smaller items to fall through the tray.

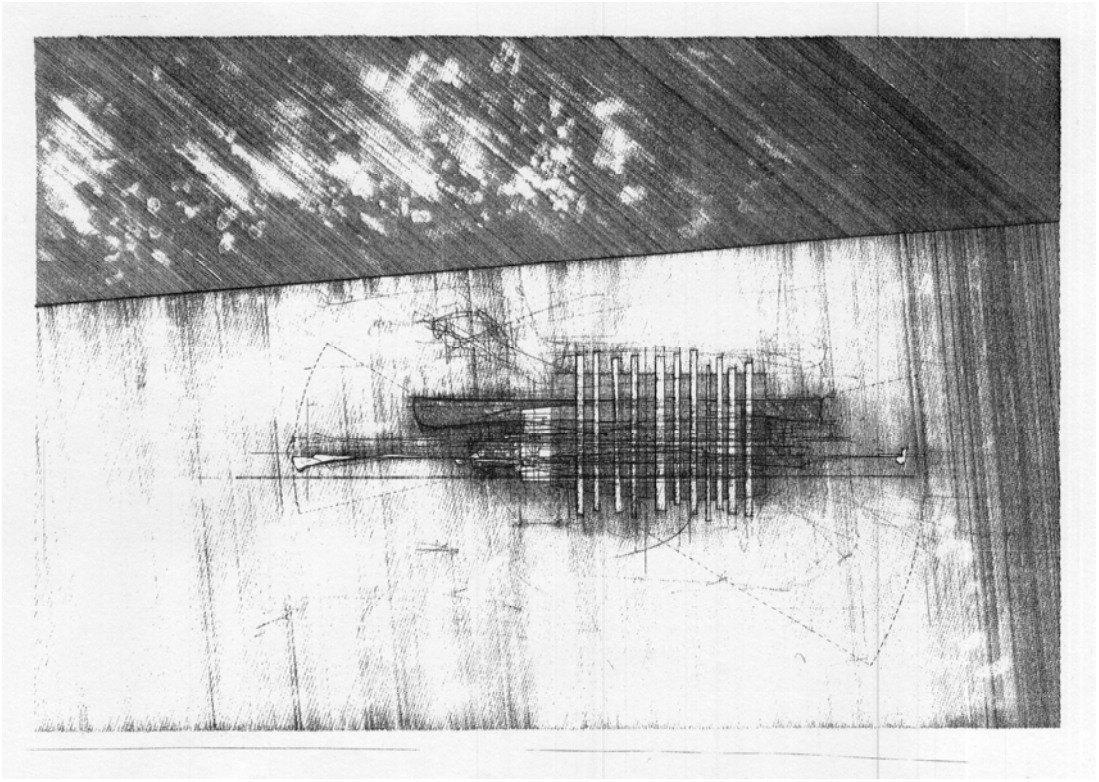

Figure 12: Itinerant toast rack, plan drawing.
A forerunner to the toast rack project featured below (see section 3.1.3.1). The idea is that the toast rack would move slowly and randomly around the surface of the kitchen table bumping into things as it went. The photocopying process is particularly interesting on this drawing as the photocopier actually broke in the process of making this copy, producing a version of the drawing which I find much more successful than the original.

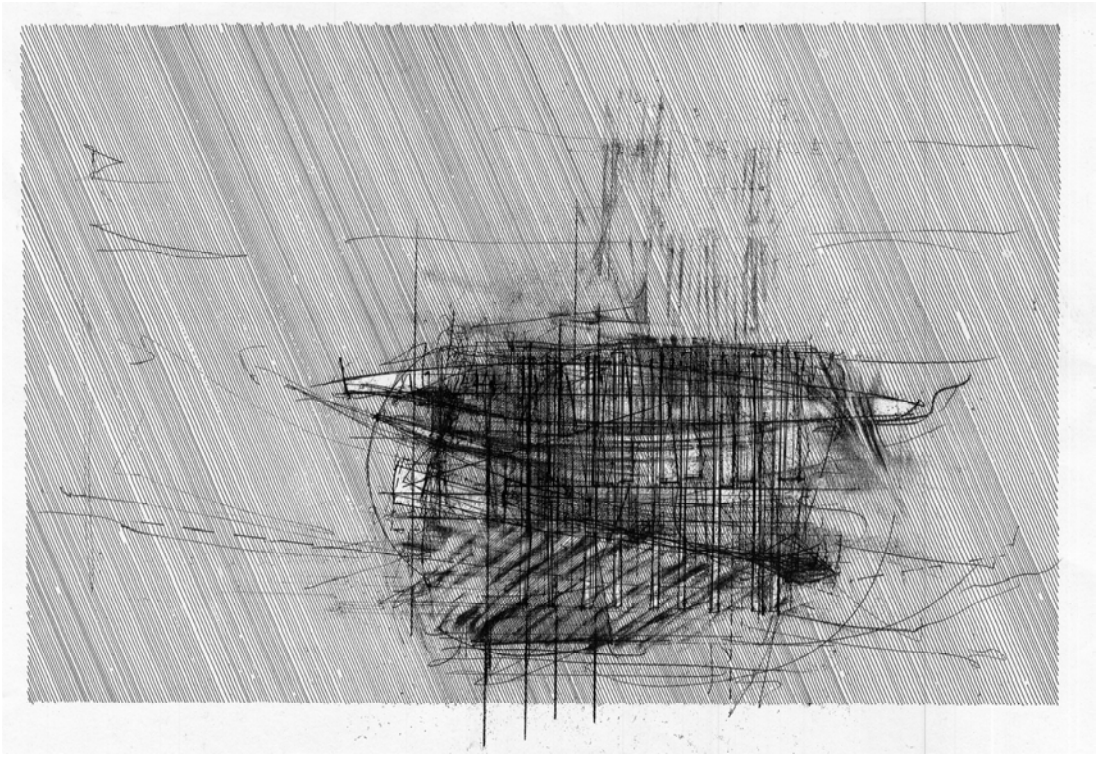

Figure 13: Itinerant object for the kitchen table, ambiguous function (1).

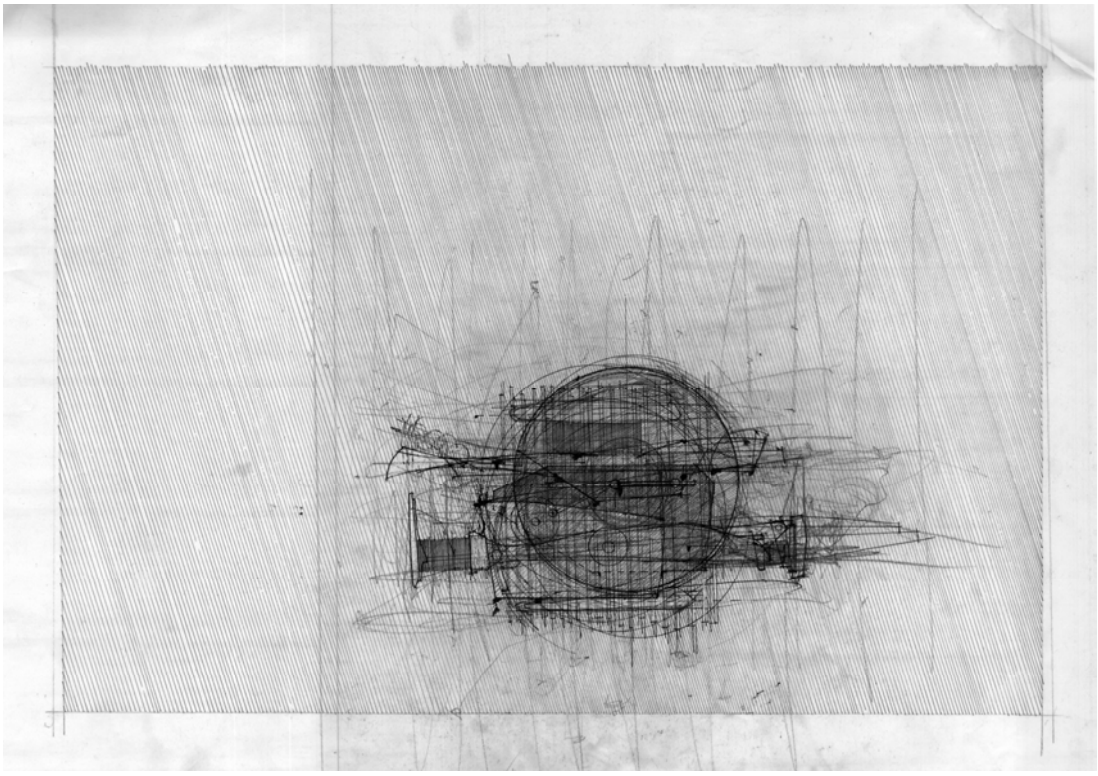

Figure 14: Itinerant object for the kitchen table, ambiguous function (2).

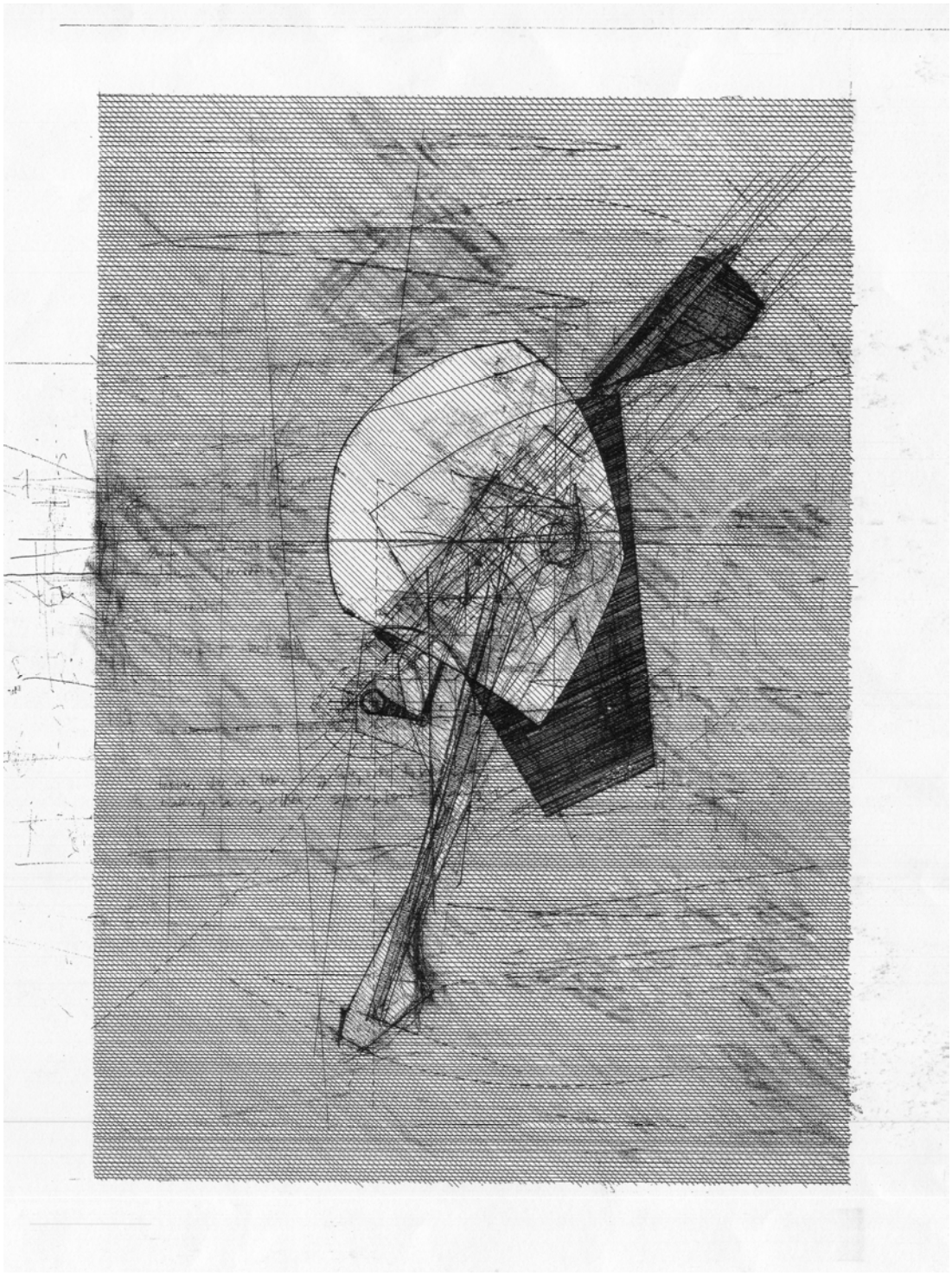

Figure 15: Itinerant object for the kitchen table, ambiguous function (3).

PART II—Being part of the world (1): epistemologically, ethically

Introduction to Part II

My argument in Part II of this thesis is predicated on two connections between design and ethics.[114] The first is that which is made possible by cybernetics. As I have noted above, the epistemology of cybernetics is understood to coincide with ethical questions (concerning our responsibility and relationships with others) and also with the epistemology of design (understood in terms of conversation). Putting these two connections together suggests a connection between design and ethics via cybernetics: if ethical questions are implicit in a cybernetic epistemology, and design is the practice of that epistemology, in what ways is it possible to talk about ethical questions being similarly implicit in design? That is, do ethical questions coincide not just with the epistemology of cybernetics but also with that of design? If so, can this help with the difficult task (difficult, given the ethical difficulty of articulating ethics) of exploring the ethics implicit within cybernetics?

The significance of this is enhanced by the second of the two connections between design and ethics on which my account is based: that there is a similarity between, on the one hand, those dilemmas with which ethical discourse is simultaneously most concerned and most confused and, on the other, the sorts of questions with which the discipline of design claims expertise. One way in which such questions can be thought about in the context of design is as what Rittel (1972) called wicked, as opposed to tame, problems. This parallel is not an exact one. There are many ethical questions which can be happily treated as being decidable while others, even though undecidable, are nevertheless examples of tame choices between alternatives. However ethics (in the sense of

[114] This largely draws on the first of the two starting points given above, that of the epistemology of second-order cybernetics and its relations to ethics and to design, but also to some extent on a development of the second, that of the contingency of designing.

the philosophy of ethics) is most concerned not with decidable or tame ethical questions—such questions being, by definition, easily resolved—but rather with those which present us with dilemmas as to how to resolve them. Given this similarity, and that designers deal with situations such as these as a matter of course even where they involve ethical content, I suggest that an understanding of design has something to contribute to our understanding of ethics.

My account therefore begins by looking at the expertise of design in dealing with such situations. In particular I address how designers' epistemology allows them to cope: (1) with wicked problems; (2) with the ambiguity of the sort of goals with which architecture is concerned; and (3) with their asymmetrical relation to those they design for. This is not intended to be an exhaustive account of the significance of design as a way of thinking. Rather I have highlighted these three issues in particular because they are specific examples where design's epistemology coincides with ethical questions.

In giving this account I am not attempting to devise a set of ethical principles, values or "ethically good" ways of acting and so to imply moral rules. Rather my observations stay within epistemology and show which ways of acting are epistemologically useful in complex situations such as in design. In examining this epistemology in the context of designing architecture, I have understood design as implicitly involving ethical considerations such as our relationships with others, responsibility for our action and choices between values. I have then related the ways in which designers approach these issues to more general ethical questions concerning our relation with others, responsibility and purpose. As a whole, this reflects back on the suggested relation between cybernetics and ethics by discussing this through the context of design and, in so doing, situates ethics via this epistemology within our everyday acting.

2.1 The conversational epistemology of designing

While there is consensus over the inadequacy of purely objective methods in design, such as those proposed by the design methods movement, when this is contrasted only with vague appeals to subjective creativity, the significance of design's epistemology is downplayed. Any appeal to subjectivity in design (and especially in designing architecture) is unsatisfactory because, given the significance of its impact on others, design cannot be regarded as merely a matter of personal preference. Considered epistemologically, design is neither objective nor subjective, nor some alternation between the two as is sometimes suggested (such as being a mixture of arts and sciences or involving both functional requirements and aesthetic qualities). Rather, the conversational epistemology of design, which is implicit in activities such as sketching, transcends this dichotomy utterly.[115]

However, despite its significance, this aspect of design's epistemology remains rather obscure—to the extent that architecture has often oscillated between the opposing paradigms of a defunct objectivity and an unsatisfactory subjectivity (as described by Vesely, 1985, 2004)—and in this the expertise of design is undervalued. This is perhaps the case because of the implicit nature of the epistemology of design. Designers do not often explicitly articulate the processes they actually undertake, it being more important to explain the reasons for an idea being worthwhile rather than the perhaps convoluted route by which that idea was developed.[116] Because it tends to remain implicit, the conversational epistemology of design can become obfuscated by the more specific methodologies that are built using it or by other tendencies in architecture such as, for instance, the

[115] See for instance the idea, advanced by Archer (1979) and Cross (1982), that design occupies a third area in education to be distinguished from both the humanities and the sciences.

[116] See also Gedenryd's (1998) discussion of the failure of the design methods movement, with reference to the mathematician Pappus of Alexandria, as conflating the structure of a proof with the process that produced it. This is also the case with science where what is done is not the same as the story that is told of what is done or, similarly, with the observations that the map is not the territory (Bateson, 1979/1985, pp. 37-38; 1972/2000, pp. 454-471; Korzybski, 1931/1933). See also Krippendorff's (2006, p. 226) remarks on the problem with using protocol analysis to study design being that it is difficult to talk about what one is doing while one is doing it.

tradition of the creative genius, where even sketches (where the activity of designing is at its most conversational) are presented as singular moments of inspiration from which whole projects follow deductively.

In order to highlight the significance of the conversational epistemology of designing I have given, below, an account of three seemingly difficult aspects of the situations which designers typically encounter: (1) that design questions take the form of wicked problems; (2) that architecture's purpose is ambiguous; and (3) that the relationship between designers and other stakeholders is asymmetric. While these features cannot be tackled by objective methods of problem solving (such as, for instance, those based on the scientific method or on logical inference), design's conversational epistemology allows designers to act in these sorts of situations as a matter of course without resorting to an unsatisfactory subjectivity.

2.1.1 Wicked problems

2.1.1.1 The characteristics of wicked problems

One way of characterising the sort of complex and ill-defined situations which designers encounter is that given by Rittel who, writing in the context of social planning, described such situations as "wicked problems" (Rittel, 1972; Rittel & Webber, 1973).[117] A wicked problem, in contrast to those that Rittel (1972) calls "tame" (p. 392), is one which cannot be solved by the sort of linear problem solving that characterised the attempt to base design on the scientific method, which Rittel refers to as "systems theory of the first generation" (p. 391).[118] Plenty is known about tame

[117] Churchman (1967) had earlier introduced the notion of wicked problems citing "a recent seminar" by Rittel (p. B-141).

[118] Rittel, who was by training a mathematician, had been a part of such attempts and, with his identification of the wickedness of design problems, moved dramatically away from such thinking. Rittel describes the first generation approach as consisting of the following steps modelled on the scientific method: (1) understanding the problem; (2) gathering information (and perhaps waiting for a "creative leap"); (3) analysing that information; (4) generating solutions or at least one; (5) assessing these solutions and identifying the best one to take forward; (6) the implementing, (7) testing and, if required, (8) modifying of this solution (Rittel, 1972, p. 391).

problems because, given that it is possible to control and analyse them, they can be extensively researched. In contrast little is known about wicked problems because they are not easily simulated, yet, as Rittel (1972) points out, "all essential planning [design] problems are wicked" rather than tame (p. 392).

There is a similarity between this and von Foerster's (1972/2003) contemporaneous observation that "the hard sciences are successful because they deal with the soft problems; the soft sciences are struggling because they deal with the hard problems" (p. 191). Von Foerster expands this, explaining that the methodology of the hard sciences, when encountering some system that is too complex to understand, is to break it into smaller and smaller pieces until it can be understood. This is invariably successful in the sense that it avoids anything that is too complicated to understand by breaking it up and, as Weinberg (1972/1991) points out, such methods of simplification are central to the practice of science. However the soft sciences, such as sociology, psychology and anthropology, cannot in principle use this method because they are the study of whole systems and the relationships between the individual parts rather than of the individual parts in themselves. Likewise wicked problems are such that they cannot be broken down into easily analysable and solvable tame parts.

Rittel and Weber (1973) describe ten features of wicked problems showing how they differ from tame ones.[119] Conklin (2006) condenses this to a more manageable list of six which I have used here as an outline, giving cross references back to Rittel (1972; Rittel & Webber, 1973).

1. "You don't understand the problem until you have developed a solution" (Conklin, 2006, p. 14). This entry on Conklin's list absorbs many of the extra features from Rittel's account. Wicked problems, unlike tame ones, cannot be exhaustively formulated as the question changes (or leads to new questions) with the situation as we act (Rittel, 1972, p. 392; Rittel & Webber, 1973, p. 161). It follows that those linear methods which require that we understand the problem at the outset are

[119] In Rittel (1972) the equivalent list has eleven entries, the 1973 version merges the first two of the preceding list.

impossible. There are two senses to this. Firstly, the question at hand (that is the question by which we explain our current action) is a consequence of our previous actions and so cannot be predicted in advance. Secondly, the questions that we explain our actions as responding to are developed with those actions as we see what possible questions they answer. In one sense this is the transformation of one sort of question into another (from one that motivates us to act to one that explains the significance of an action) but in another sense these are two sorts of thinking which are always being updated (explaining what we are trying to do and the significance of what we have already done). There are many different explanations of any situation and any wicked problem can always be thought of as a symptom of another so that our choice of explanation will determine the nature of the solution we propose (Rittel, 1972, pp. 392-393; Rittel & Webber, 1973, pp. 165-166).

2. "Wicked problems have no stopping rule" (Conklin, 2006, p. 14; Rittel, 1972, p. 392; Rittel & Webber, 1973, p. 162).[120] That is, because there is no clearly formed solution, or indeed problem, there is no end point, no final answer—it is always possible to try to do better. We will usually stop when some solution is judged to be good enough or else because of external limitations such a lack of time or budget. However we could always continue to try to improve any proposal further.

3. "Solutions to wicked problems are not right or wrong" (Conklin, 2006, p. 15; Rittel, 1972, p. 392; Rittel & Webber, 1973, p. 162). Whereas with a tame problem a potential solution will either be right or wrong, solutions to wicked problems will only be better or worse, good enough or not good enough, viable or unviable. These sorts of judgements may well vary with different stakeholders and criteria—a solution may be good for one person but not for another and so some solution may possibly be *both* better *and* worse simultaneously in different terms. Related to this is the idea that there is "no immediate and no ultimate test of a solution to a wicked problem" (Rittel & Webber, 1973, p. 163) as one cannot make a judgement until all the consequences have played themselves out and, as there is no time limit to this, no such judgement can be made.

---

[120] In this and the following features of wicked problems I have quoted them as given by Conklin (2006, pp. 14-15) and given references to the corresponding ideas by Rittel (1972; Rittel & Webber, 1973) which are phrased slightly differently.

4. “Every wicked problem is essentially unique and novel” (Conklin, 2006, p. 15; Rittel, 1972, p. 393; Rittel & Webber, 1973, p. 164). Although one can learn about the nature of wicked problems generally, each one is individual and successful strategies cannot be directly applied from a past situation to a new one.[121] There can therefore be no universally applicable method for solving wicked problems.

5. “Every solution to a wicked problem is a ‘one shot operation’” (Conklin, 2006, p. 15; Rittel, 1972, p. 393; Rittel & Webber, 1973, p. 163). That is, it is not possible to work by trial and error because by enacting a solution one changes the substance of the problem. This relates to the idea in Rittel’s longer lists which is otherwise not included within Conklin’s formulation—that with wicked problems there is “no right to be wrong” (Rittel, 1972, p. 393; Rittel & Webber, 1973, p. 166). Unlike science where progress is generated through the refutation of hypotheses, and so error is an expected and acceptable part of the process, the effects of solutions to wicked problems matter a great deal to the people they affect. This creates a bind when considered with feature 3—there is no way to be right but no right to be wrong. Thus the impossibility of being right does not support being unrigorous, irrelevant or acting only out of personal preference.

6. “Wicked problems have no given alternative solutions” (Conklin, 2006, p. 15; Rittel, 1972, p. 393; Rittel & Webber, 1973, p. 164). Tame problems have a finite set of possible responses. This is the case even with some undecidable questions which can be stated as a clear choice between (albeit incommensurable) positions (such as for instance that of the choice between being part of and apart from the world). Wicked problems are those which cannot be stated clearly as a list of permissible options and so are those where “everything goes” (Rittel, 1972, p. 393) in terms of potential approaches.

---

[121] We can repeat strategies at a higher logical level. That is, we can develop repeatable strategies for developing specific responses to unique situations. Contemporary design education is concerned with developing this sort of transferable ability. This is in contrast to the teaching of given strategies to be deployed in predictable situations which had been a feature of classical and modernist eras of architectural education.

In these features there is a similarity between wicked problems and undecidable questions but they are not identical concepts. A wicked problem is undecidable in that there is no definite answer implied by the question. Undecidable questions share features 2 and 3 on the above list—they have no right answer and no stopping rule. However undecidable questions do not necessarily share the other features. Many undecidable questions have similar structures to each other (being undecidable for similar reasons such as under-constraint, over-constraint or self-reference) and so can be approached in similar ways (compare feature 4), are definable (whereas with a wicked problem it is not even possible to be sure what it is that is undecidable (feature 1)) and can be formulated as choices (compare feature 6). Most significantly of all, undecidable questions are often not one shot operations as they leave the possibility of being decided differently in the future. It follows therefore that while wicked problems are always undecidable, not all undecidable questions are wicked and while all decidable questions are tame, not all tame questions are decidable (that is, there is a class of questions which are both tame and undecidable).

Rittel's account is not so much a definition or an explanation of why design problems are wicked but a description of the difficulties of such situations (Conklin, 2006, p. 16). One of the most conspicuous manifestations of wicked problems is that of over-constraint, where it is not possible to combine the various requirements of a situation in commensurable terms. However, while over-constraint leads to undecidability, an over-constrained question may just involve a tame undecidable choice between alternatives. In all the features which Rittel describes, it is the inclusion of time and of observers which is crucial to the wickedness of wicked problems. Where a question is considered over time and where it includes active stakeholders within it, as is the nature with all questions in design, one cannot specify in advance how to act because the situation is always transforming into something new.[122] Indeed, given that the purpose of design is to transform an

[122] Buchanan (1992, pp. 16-17) emphasises the involvement of the designer in defining the otherwise indeterminate nature of design. This can, I think, be expanded to the involvement of all stakeholders. With this issue in mind,

existing situation into a new one in some way, it is design itself that leads to the wickedness of the situations that designers encounter.

2.1.1.1 Wicked problems and the epistemology of designing

How then can we approach wicked problems? One approach is to tame them—to make them solvable by limiting them in some way (Conklin, 2006, pp. 21-23). This is equivalent to arbitrarily making an undecidable decision into a decidable one or breaking it up as per von Foerster's (1972/2003, p. 191) description of the hard and soft sciences noted above. Such attempts are generally reductive, although perhaps sometimes we do mask or misunderstand tame problems as being wicked. However while wicked problems appear to be intractable when viewed from the point of view of logical reasoning, they are characteristic of the situations that designers encounter and deal with as a matter of course, to the extent that from a designer's point of view it is difficult to see what the fuss is about.

That a problem is not understood until after the formulation of a solution (feature 1 above) is to be expected in design and designers approach situations by making proposals rather than through exhaustive analysis.[123] As Bruce Mau (1998/2011), referencing John Cage, tells us, it is often helpful to "begin anywhere" (para. 9) and the conversational circularity of design means that such a beginning, though arbitrary (it is not determined but chosen) in itself, does not lead to arbitrariness (in the sense of any proposal being equivalent to any other) as any starting point can be evaluated and developed in terms of the various criteria, constraints and opportunities of the

---

Negroponte (1970, pp. 3, 69) likens designing architecture to the game of croquet in *Alice in Wonderland* where the rules keep changing (Carroll, 1865/2001, pp. 99-114).

[123] See for instance Lawson's (1979) study. Cross (2007a, pp. 22-23) and Lawson (1979, p. 66) characterise design as being solution focused as opposed to the problem focused approach of science. However even this terminology, referring to solution and problem, is misleading in that it implies both that design situations are problematic (in the sense of needing to be solved, which is not necessarily the case; see, for instance, the Allotment Calendar and other projects below where there is no sense of anything needing to be solved in the existing situation) and also that they can be solved once and for all. I've tried to refer to situations rather than problems and proposals rather than solutions.

situation. Indeed, designers learn about the situations in which they are designing mainly through making and evaluating proposals. This allows them to improve not just their proposal but also the aims and goals of the project, perhaps redefining it completely—an important process given that such situations are all essentially unique (feature 4) and have no set of given alternative solutions which can be picked from (feature 6).[124]

Two of the apparently problematic characteristics of wicked problems—that there is no right answer and no stopping rule to a wicked problem (features 2 and 3)—can even be thought of positively in the context of design. These two features, which are those that wicked problems share with undecidable questions, imply each other—there is no stopping rule because no answer is definitively right and there can be no right and so final answer to a process that is on-going. Whereas Rittel saw these as problematic, they can also be seen as a way of acting in response to such situations. Conversation and sketching have no stopping rule because they are circular in structure and each action potentially leads to a further one. They can be continued endlessly and we must choose where to stop them (notwithstanding limitations external to the question at hand, such as time and fees). This relates to cybernetics' distinctive attitude to error where it is understood as neither good nor bad but instead as something to be expected and even as driving the process of circular feedback (Ashby, 1956/1964, pp. 219-243; Barnes, 2007, p. 77; Glanville, 2007e, p. 1181; Pask, 1980, p. 1006).[125] To treat a question as having no stopping rule is to leave open possibilities we have not yet thought of and also to consider any proposal capable of further improvement.[126] Interpreting these features of wicked problems in this way, we might enjoy their unpredictability

---

[124] In this way the design process itself can, as Negroponte (1970, p. 119; 1975, p. 34) put it, be thought of as the procurement of the missing information required to clarify the brief.

[125] In a second-order cybernetic and radical constructivist understanding, error is perhaps an inappropriate term, implying the reference to some correct value and it is perhaps better to use "difference" instead, which Ashby (1956/1964) has called "the most fundamental concept in cybernetics" (p. 9). However there is a sense in which redefining the implications of error is an important gesture.

[126] This always leaves us with questions to work at. On the importance of this, see also Glanville (2002a) on de Zeeuw.

rather than seeing it as a problem. There is a freedom that comes with there not being one given solution and a novelty that comes from not knowing in advance what the results of one's actions will be. While the carefree nature of such an approach is in contrast with Rittel's characterisation of wicked problems—for instance, that there is "no right to be wrong" (Rittel, 1972, p. 393; Rittel & Webber, 1973, p. 166)—such playfulness is implicit in designers' approach to complex situations even when they are being explicitly serious and, indeed, without detracting from this seriousness.

The remaining feature on Conklin's list, that every solution to a wicked problem is a one shot operation (feature 5), and the feature from Rittel which is related to this, but not explicitly noted in Conklin's formulation, that there is "no right to be wrong" (Rittel, 1972, p. 393; Rittel & Webber, 1973, p. 166) are more difficult for design, and particularly for architecture, to handle.[127] Any implementation of a proposal is significant and cannot be undone. One cannot (usually) build a building just to test out a possible solution as this already consumes immense resources and impacts on large numbers of people. Designers work around this by using media, at various levels of abstraction, to develop and test their ideas before implementing them. A drawing, unlike a building, is not a one shot operation and can easily be made again and again and ideas refined through this. Indeed it is always design that we turn to when faced with one shot operations in order to predict how our action will work out in advance.

2.1.2 The limitations of rules and the ambiguity of purpose

2.1.2.1 Making architecture decidable

While there is consensus that the situations that designers encounter are wicked there are many individual aspects of designing that are not. Some decisions, particularly more technological ones, have clear options which are to be decided between and even where these are undecidable

[127] In arguing that design is a way of acting in response to wicked problems, Glanville (2011) does not address either of these more challenging features explicitly—subsuming the idea that every solution to a wicked problem is a one shot operation into his discussion of their uniqueness and not directly addressing there being no right to be wrong because of working from Conklin's formulation which omits it.

they may still be tame. The design of architecture has on occasion been treated as being largely decidable, albeit with mixed success. It is possible to distinguish two different tendencies in this: the first concerned with a systemisation of method, such as the design methods movement, and the second with a systemisation of architectural form, such as the development of various styles which once opted into determine (some) design questions for us. These tendencies are related although they do not necessarily entail each other. While attempts to systemise the design process have generally been characterised by failure, as described by for instance Cross (2007b, p. 42) and Gedenryd (1998) as well as by Rittel (1972), the codification of architecture into a variety of styles has at various times been successful, to the extent that many great buildings have been created in this way, and so cannot be dismissed out of hand.

To what extent can aspects of designing architecture be treated as being decidable? Is such thinking always inappropriate given the overall wickedness of the situation or can it still be appropriate on some occasions or in part (for instance with technological questions)? Perhaps it is strange to raise this question after the preceding discussion of wicked problems, yet it remains a contemporary issue given the rapidly expanding possibilities of computing. However, because the distinction between decidable and undecidable decisions is not a property of the content of the question itself but of how it is contextualised, it does not make sense to ask whether designing architecture *is* decidable or undecidable. Rather, the decidability of designing architecture is a matter of choice and it is therefore the nature of this choice and the characterisation of architecture implicit in what we choose that is of importance. Understanding the decidability of architecture as a choice is indeed implicit in the idea of an architectural style especially where styles are thought of as a range of possibilities to be chosen between, such as for instance the debates between the gothic and various classical styles during the nineteenth century. In this, as well as where a style has claimed universal priority for itself, it is the undecidable decision to opt into the style which makes the decisions that follow decidable. The question is therefore not whether architecture is or is not decidable or undecidable—but whether we want to choose to treat it as such and in so doing to make the decisions or assumptions required to do this.

While both the attempt to objectivise the design process and, for the most part, the following of a style are now defunct ideas, contemporary developments in computing such as building information modelling (BIM) and parametric design, which have extended the reach of designers in ways which could not have been done manually, are similarly based on automating various design decisions such that they follow deductively from others.[128] While this creates new possibilities it sits oddly in the context of design. I do not mean to suggest that the use of these tools makes the design process itself deterministic—the use of both BIM and parametric design tends to be confined to questions of a technological or geometric nature and one can distinguish the computerisation of some procedure which is then to be incorporated into the design process from the attempt to computerise the design process itself.[129] However the extension of this approach, as Schumacher (2008) has suggested, to responsively interacting environments and to urbanism places it in the context of a realm of architecture which cannot be characterised as purely technical because it is concerned with human occupation. While we might propose some division between those aspects which can be computerised and those for which this would be reductive—perhaps between technology and aesthetics or between objectivity and subjectivity—such a distinction, as Vesely (2004) has argued, is problematic in itself and would be difficult to maintain in practice in any case. Understanding that the decidability of a question is a matter of how we frame it, this is a matter for us to choose and the issue is not whether a question can be computerised or not but whether we find it appropriate or helpful to frame it in this way. Again, it is notable that we cannot remove ourselves from this decision and that it remains our choice.

---

[128] While it may seem strange to compare parametric design to attempts to objectify the design process given its disregard of functionality and its positioning of itself as an avant-garde (for instance Schumacher, 2008), the parallel with a style is more easily made and indeed Schumacher (2008) has even declared that "Parametricism is the great new style after modernism" (para. 3). BIM is more easily associated with efforts to systemise or rationalise the design process yet there is also a sense that, given the necessity of deciding many decisions in advance, its use potentially leads to a style or styles of its own.

[129] See for instance Negroponte (1970, pp. 22-26).

2.1.2.2 The limitations of rules

While recent developments in computing are a reason for the contemporary relevance of discussing design in terms of its undecidability, it is also interesting to take the use of computers as an example and in particular the work of Negroponte (1969a, 1969b, 1970, 1975) in the late 1960s and early 1970s during the formative period of the use of computing in design. While the contemporary possibilities of computing far outstrip those with which Negroponte could experiment, there is a continuing relevance in terms of what tasks a computer can in principle undertake and in many ways this is more explicitly addressed by Negroponte than by more contemporary developments. Negroponte writes contemporaneously to the reaction in design theory against preceding attempts to scientise design methods, contemporary with for instance Rittel (1972). Indeed the enduring legacy of Negroponte's architecture machine work can be thought of as a contribution to design theory as much as it is to computing—the attempt to embody the design process in a machine making it explicit (see similarly Frazer, 1995).[130]

Negroponte (1975, p. 35) distinguishes two approaches which relate to two general attitudes to artificial intelligence. Firstly, the attempt to embed knowledge (such as the ability to design something) directly into a machine where the machine is in itself not intelligent but can act intelligently and, secondly, giving machines the ability to learn and improve through experience for themselves and so learn how to design. These two strategies relate to the epistemological ideas introduced above as well as to the cybernetic idea of conversation.[131] To try to embed knowledge is to treat it as being a commodity which can be transferred, and so in the sense of it being a match or correspondence with the truth, and so acts in terms of us being apart from the world. In contrast, to give a machine the ability to learn is to consider it part of the situation it is designing for and Negroponte's human-machine dialogue is an example of a conversational interaction (and so in itself

[130] As Scott (2007, p. 32) notes, Pask, who collaborated with Negroponte, was similarly concerned with embodying his theories in artefacts.

[131] Pask was one of Negroponte's collaborators and advisers and contributed to *Soft Architecture Machines* (Negroponte, 1975; Pask, 1975a). The conversational nature of Negroponte's approach shows the influence of Pask.

very like the design process). Negroponte is critical of the embedded knowledge approach, and particularly some of its manifestations such as optimisation (1975, pp. 187-189), and favours the second, adopting a strategy of developing an interactive relationship between human designer and computer, a computer-aided paradigm rather than the computerisation of design (1970, pp. 22-26). Thus the machines he develops ask questions, explore and learn as part of a partnership between designer and machine.[132]

Negroponte makes a series of criticisms of the computerised approach. In particular he identifies two features of designing architecture, terming them "anomalies" (1975, p. 33), which mean that a computerised approach will run into difficulties: a dependency on context and an abundance of missing information (these are notably similar to the characteristics with which Rittel (1972) defined wicked problems). Architecture's context dependency means that design cannot be satisfactorily codified into universally applicable rules: "any axiom or rule can find a situation where it will fail or generate disaster when blindly executed as a truism. I do not believe that there are *truths* in architecture; all principles are qualified by *context*" (p. 33). The second of these anomalies, missing information, is, according to Negroponte, so characteristic of the situations designers face that "part of the design process is, in effect, the procurement of this information" (1970, p. 119;

[132] See also Bateson (1972/2000) who, considering whether a computer thinks, describes the thinking system as not the computer but "the man *plus* the computer *plus* the environment. And the lines between man, computer, and environment are purely artificial, fictitious lines" (p. 491). The sense of human-machine partnership in Negroponte (1975) is emphasised by the contributions from Pask and Yona Friedman. Pask describes intelligence as "a property that is ascribed by an external observer to a conversation between participants if, and only if, their dialogue manifests understanding" (Pask, 1975a, p. 8). Friedman, introducing computer-aided participatory design, considers the machine to be "only and exclusively a system containing the machine and me" (Negroponte, 1975, p. 93). This partnership is also the underlying significance of the use of "soft" in the title. While Negroponte only explicitly refers to soft machines as information technology and also to the literal softness of materials (1975, pp. 145-150), his argument as a whole implies the blurring of the boundary between human and machine in their interaction rather like (albeit in a rather different sense to) the earlier use of the term "soft machine" in Burroughs' (1961/1968) novel of that name.

1975, p. 34).[133] Architecture involves so many variables and possibilities that, at the outset of a project, it is impossible to know every factor or requirement. Even in a relatively simple project, stakeholders will often change their minds as the design develops. While designers often put this down to indecisiveness on behalf of their clients, it is rather a response to new possibilities and requirements being understood in response to seeing design proposals worked through and as such it is equally a characteristic of designers themselves. Because missing information and context dependency cannot be accounted for in advance it is impossible to computerise the design process as a whole without doing so arbitrarily.[134] This is however not so much a limitation of automation in a technological sense as in a conceptual one—it is the setting of rules in advance (however sophisticated) which cannot accommodate a design situation's ill-definition and this is equally applicable where such an approach is undertaken manually as where via technology.[135]

A parallel with this is that given by Crane (1995/2003, pp. 118-123), in the context of artificial intelligence, using the story of a bus driver who, adhering strictly to the rules of his job requiring that he only leave his route with permission, does not deviate from this in the advent of a girl suffering a heart attack on his bus. Additional rules could be given to the bus driver but these could not account for every eventuality without multiplying endlessly and in such situations we expect each other to use our common sense. Common sense cannot be successfully coded into rules as, similarly to design, it is context dependent (see also Dreyfus, 1972/1979). This not only has consequences for the limits of artificial intelligence but also for how we approach rules

---

[133] This is an instance of the feature of wicked problems, described above, that a problem is not understood until the formulation of the solution.

[134] My favourite example of this arbitrariness is that of the "Building Optimization Program", designed for Skidmore, Owings and Merrill, which could be run without a single input to produce a 500,000 gross square feet office building (Negroponte, 1975, p. 186).

[135] While these two senses of automation are often associated with each other they are not identical. It is possible to have conceptually automated yet manual processes (for instance, a deductive inference) and also technological automation which is not conceptually automated such as, for instance, the randomness of Dr Faustroll's painting machine (Jarry, 1911/2006, pp. 195-196) or the interactivity of Pask's Musicolour (see Pask, 1971).

generally—there will always be situations which cannot be accounted for in advance and where we must use our own judgement. Given this, design can be seen to be particularly valuable as, like common sense, it allows us to deal with ill-defined situations (despite context dependency and missing information) but whereas common sense remains difficult to define, the design process can be studied clearly.[136]

2.1.2.3 The ambiguous purpose of architecture

The complexity and ill-definition of the situations which designers face is not merely a matter of defining these situations more carefully or thoroughly but, rather, is an in principle quality traceable to architecture's purpose. This is not to say that we cannot treat such situations as being tame—as I argued above we can always make a situation decidable (and so tame) by framing it as such and taking up its undecidability elsewhere—but that to do so is not an achievement of objectivity but something we are responsible for.

The wickedness of designing architecture follows from the many different, and sometimes incompatible, goals with which it is concerned. With limited space and resources it becomes necessary to compromise between goals and we could characterise the situation as being over-constrained. If these different goals could be stated in commensurable terms, say with reference to the overall purpose of architecture, then it would be possible to weigh up between them—and the question could be treated as a tame one and design proposals optimised against this overall goal. However, architecture's purpose is such that it cannot, in principle, be reduced to one

[136] It is perhaps possible to assert some kind of connection between design and common sense. This is suggested by the way in which design is something that everyone practices to some extent in everyday life (Cross, 2007a, p. 41; Glanville, 2010; Jonas, 2007b, p. 1364; Krippendorff, 2006, pp. 31, 71-4; Nelson & Stolterman, 2003, p. 1; Simon, 1969/1996, p. 111).

commensurable value or criteria and, as Negroponte (1975) has pointed out, optimisation can therefore be thought of as "extremely antagonistic to the nature of architecture" (p. 189).[137]

One way of defining the goals of architecture is that given by Vitruvius in *The Ten Books on Architecture* as being concerned with "firmness, commodity and delight" (I.iii.2, trans. 1624). There is something intangible about the third of these, delight. It is difficult to say definitively what is or will be delightful as it is concerned with our subjective experience and so with our individual purposes and preferences. This can similarly be seen to be the case with commodity (usefulness or function), even though it at first sight seems much more objective, as something's usefulness cannot be separated from our using it. Even firmness (structure, stability), while being much more obviously a technical property, is inseparable from the other two in that it enables them and can also be thought of as being concerned with the appearance of stability as much as with stability itself, as Eisenman (2008, p. 53) has pointed out with reference to Alberti's *De Re Aedificatoria*.

An alternative definition of architecture's purpose is in terms of our purpose, such as that given by Negroponte, as the support of the good life (Negroponte, 1970, p. 69; 1975, p. 135).[138] This is implicitly also a classical reference. The good life or *eudaemonia*, often translated as human flourishing, is Aristotle's description of our *telos* (our goal or purpose) in the *Nicomachean Ethics*. If we take this as our understanding of the goal of architecture then this includes us and our purposes within its definition. One can then see the many and diverse goals of any design question as

---

[137] Negroponte (1975, p. 287) references Simon's (1969/1996) term "satisficing" (pp. 27-30) which he proposes as an alternative to optimisation.

[138] For Vesely (2004), similarly, "the goal of architecture is human life" (p. 5). Although this might be considered overly anthropocentric, either in the sense of the sort of the post-functionalism of Eisenman (1976/2000), where architecture is considered to be an autonomous discipline, or else in the sense that architecture involves not just humans but also the environment, it can be meant in a broad sense as being concerned with the artificial (see for instance Shepheard, 2003; Simon, 1969/1996, pp. 1-5)—that is with whatever we do—and so including our relation to the environment and the autonomy of our disciplines. Understanding it in this way, we cannot escape the architectural any more than we can our experience.

following from the many and diverse goals of our lives and the incommensurability and plurality of such goals as again reflecting that of our own. It is our inclusion that is at the root of the architecture's characteristic ill-definition. It is because it involves us that information is missing and strategies are dependent on their context. Even where our goals are seemingly predictable it is not certain that this is how we will choose to act—as for example the protagonist of Dostoevsky's (1864/1993) *Notes from Underground* who considers deliberately rejecting the idea that two plus two equals four and instead having it equal five in order to validate his own individuality over what is logically required. Negroponte likens designing architecture to the game of croquet in *Alice in Wonderland* where the rules keep changing (1970, pp. 3, 69) and also comments that "if there is a best, it is in the mind of the user, and…even that 'bestness' changes from day to day" (1975, p. 187).[139]

If we take *eudaemonia* as an overall goal, then does it potentially offer us a source of commensurability where we are faced with over-constrained choices? Though this is indeed one reason for the renewed interest in it as a concept in ethics (for instance by MacIntyre, 1981/1985), it is by nature an ambiguous idea—to flourish is not an extrinsic goal which can be straightforwardly defined but an intrinsic and personal one.[140] While the idea of the good life as an overall goal potentially introduces some commensurability to the terms of a debate, its ambiguity (following from its inclusion of us within it) is such that it does not resolve between different priorities for us but rather opens them up further.[141] As Negroponte (1970, p. 69) has put it, the good life cannot be optimised.

---

[139] See Carroll (1865/2001, pp. 99-114).

[140] Even MacIntyre (1981/1985) struggles to define it, using the provisional definition that "the good life for man is the life spent in seeking for the good life for man" (p. 219), leaving himself open to the sort of criticisms of liberal pluralism advanced by Eagleton (2007, p. 50). However while in MacIntyre's narrative this seems like a disappointing conclusion, from the point of view of second-order cybernetics this self-reference is potentially a source of strength and one which I return to below.

[141] Indeed this is one of the main points of contention about virtue ethics, as raised for instance by Louden (1984/1997), that it offers little direct guidance for our actions or judgement.

2.1.3 Designing for others

Above I have introduced the analogy between design and conversation through the example of understanding drawing as a conversation that designers hold with themselves. However, the nature of conversation in designing is not limited to only this sense of conversation with oneself via drawing. It also, and indeed more obviously, includes the conversations designers have with others. It seems natural to associate these two aspects of design's conversation. The most obvious connection is the way drawings, and the conversational quality of the activity of drawing, allow designers to widen their own design conversation allowing others to comment and participate. Beyond this I propose two arguments: (1) that such a dialogue with others is as much an epistemological activity as a participatory one and so an integral part of designing rather than something added-on to it; and (2) that even the solitary conversation of sketching can be thought of as a participatory activity in that it allows the designer to anticipate and act in relation to others.

2.1.3.1 That participation in design is epistemological

Designers' dialogue with others plays a similar epistemological role to that of their dialogue with themselves in drawing. It is a process through which designers can test how some proposal is received and also learn about those who receive it, exploring the situation that they are designing for. However such a dialogue with others is difficult to establish, and can even seem a rather idealised aim, because of the asymmetry between designers and those they design-for. This asymmetry, and the difficulty of dialogue which follows, is not necessarily problematic in itself. Where some question either has an uncontroversial right answer (i.e. where we regard it as decidable or experience it as tame) or where it can be satisfactorily regarded as a matter of preference, then its asymmetry is of little consequence. Where a decision is however both ethically significant in its impact on others (i.e. it is not merely a matter of preference) and is also undecidable, then any asymmetry between the agency over and impact of a decision is potentially a source of contention. While not all decisions which designers encounter are of this order, many are. Architecture forms part of the fabric of other people's lives and is therefore not merely a matter of preference, while it also, for much the same reason, cannot be designed on the basis of objectively

agreed rules and so can only be a matter of opinion.[142] When we encounter situations such as these in everyday life (that impact significantly on others but where it cannot be agreed what course of action is best) we will normally seek consensus amongst those that will be affected by the decision.[143] However in the case of designing architecture such consensus, or even something approximating it, is impossible to achieve. The impact of architecture is so great that we will never (except in the simplest imaginable circumstances) be able to even consult every stakeholder let alone find agreement amongst them. While in many situations we can follow von Foerster (1990/2003) in limiting ourselves to the question of what *we* should do (ethics) rather than what should be done by others (morals), such a distinction is impossible to maintain in the case of designing architecture because intervening in the lives of others is the very point of the discipline. The combination of these three characteristics therefore presents something of a dilemma to the designer. Whereas both architecture's significance and undecidability are intrinsic to it (one would not want an architecture which was not significant while its undecidability is for the most part unavoidable), one can at least try to bridge or otherwise ameliorate design's asymmetry, although this is difficult to achieve in the circumstances.

Although design can be understood in terms of conversation, designers cannot in practice always act out their relations with others in a conversational way and instead must act in terms of their own understanding of the situation. Where designers rely primarily on their own ability to propose a solution this can become paternalistic and so ethically problematic even should it be successful. There are also practical difficulties to this as it is difficult to understand a situation which includes others without interacting with them. Many architects have however worked like this and continue to do so—indeed it is often for their distinct personal vision that they receive critical praise and are commissioned on a project. However, while one alternative to this is to subdue the agency of the designer in favour of that of other stakeholders, this is also to fail to generate dialogue

---

[142] This is an instance of the bind of wicked problems, discussed above, where there is no right answer but no right to be wrong.

[143] I think this is not a controversial point but what is and is not contestable and of ethical significance often is.

despite appearing generous and participatory. To give people only what they express that they want neglects the responsibility of the designer to act for them (to create unimagined opportunities, to act for those whose voices are otherwise not heard) and is to avoid responsibility—or at least, accepting the idea that we cannot avoid our responsibility, to try to do so, and so to avoid taking responsibility for our responsibility. While this can appear to be engaging with others, it is not to form a dialogue because there is no interaction. It fails to give the client what they want from a designer—a design proposal rather than just a restatement of their own ideas—as well as failing to act for other stakeholders whose voices are not present. There is no dialogue in acquiescing to others any more than there is in paternalism—they are each effectively monologues.

However, despite their weaknesses, these are common tendencies in design practice. This is understandable given what I have described as the asymmetry between designers and those they design for, which makes it difficult to form a conversation any more substantial than a staccato exchange of information, and the divergence of goals and agendas amongst architecture's various stakeholders. However, a cybernetic understanding of conversation suggests a different (and more optimistic) approach to the difficulty of this context: in conversation differences or conflicts are understood not just as being resolved but as driving the whole process (Barnes, 2007, p. 77; Pask, 1980, p. 1006). Although agreement can seem an impossible goal, conversation and indeed design show that agreement is not necessary in order to participate with each other.

Part of the design process will often be to attempt to establish dialogue with other stakeholders—whether through relatively standard consultations or through various participatory design approaches. Such attempts can sometimes be regarded as something of an add-on to the design process and do not necessarily lead to genuine participation or significant interaction (see for instance Till, 2005). Sometimes consultations are participative in appearance only while even the most genuine of attempts can fail because of the difficulty of the task. However, while such participatory or collaborative approaches are often viewed as either an innovation or an amelioration of the design process, such a dialogue is crucial to design and—understanding design in terms of conversation—is an integral part of it.

This is partly manifest in drawing. In a simple sense, drawings and models make dialogue possible by making architectural ideas communicable and so help a discussion to take place.[144] The value of drawings is not just that they illustrate ideas but that they do so in a way that makes these ideas easily manipulable and makes this manipulation sharable. One can start drawing or sketching together or can mark-up ideas over other drawings. While making drawings together in this way is commonplace in design practice and teaching (such as Figure 1), it is a significantly participative epistemological activity which merges with that of designers' individual thinking. The inclusion of others within the design process is, in this respect, not solely for the sake of ethical considerations (involving others in what will affect them) but as part of design's epistemology. It is only through such interactions that we can learn about the situation, which, as Rittel (1972, p. 393) pointed out, is essentially unique.

2.1.3.2 That the epistemology of drawing is participatory

While the most explicitly participatory quality of drawings is that they allow us to share an idea with others or to develop ideas amongst a group, the conversation that drawings allow designers to sustain with themselves is also participatory. In conversation, it is only by seeing how we have been understood that we learn what is implied by what we have said and, through this, about those we are speaking with. Similarly, in designing, as I have just discussed, it is through how others respond to our proposals that we learn about what we have designed and the situation in which we are working. Such interaction is often difficult in the case of architecture because of the sheer number of stakeholders and their often tangential relation to the project itself (consider for instance the passer-by and the future user). Given this, drawings allow designers to actively anticipate how their proposals would be experienced. Designers use drawings to put themselves in the place of others by "walking through" the plans or otherwise imagining themselves in the place of

[144] Although, as Till (2005) points out, standard architectural drawings are difficulty to interpret for those not well versed in their conventions. This is, however, part of the challenge in making a drawing. My argument stresses the participative quality of the activity of drawing rather than the representational role of drawings as images of what is proposed, which is what Till criticises.

those that will use what they design. This allows designers to see “through the eyes of the other” (in von Foerster’s (1991) phrase; see section 2.2.1 below). There is therefore a sense in which design is always participatory, even in the absence of explicit dialogue with others, because to design is to anticipate others and to make them present in one’s action.

In this way, even dialogue with oneself (such as through drawing) can be understood as a participatory, and so an ethical (in the sense of involving ethical questions rather than being ethically good), activity as well as an epistemological one, just as dialogue with others is not solely ethical but also epistemological. Comparing the case of drawing to that of participatory design, we can distinguish genuine dialogue from monologue in both cases and contrast the participatory quality of the dialogue that designer’s conduct with themselves with the often monological nature of apparently participatory consultation. The crucial aspect of participation in both cases is the establishment of dialogue rather than simply the incorporation of others into the process. This participatory quality of design does not of course mean that all designing always incorporates others successfully or genuinely. Design has other tendencies too which can obscure its participatory aspects, such as the paternalism of the architect as genius or expert and the supposed altruism of giving people what they want. Yet, that there is a participatory process implicit in design’s epistemology means that, despite these other tendencies and the difficulties of circumstance, such considerations are not external limitations on design but are part of its own epistemology.

2.2 Ethics and epistemology in cybernetics and design

Above I have highlighted three aspects of designing architecture where epistemological and ethical questions coincide: wicked problems, the ambiguities of the purpose of architecture and the asymmetry of the relations between designers and those they design for. These are characteristic features of the situations which designers encounter and, whereas they cannot be resolved by logical problem solving, the conversational epistemology of designing allows designers to approach them with confidence. These are each instances of more widely relevant ethical questions: (1) that of how to act when faced with incompatible requirements; (2) that of the meaning or purpose of life; and (3) that of the relation between acting for oneself and acting for others. In this section I have related the account I have given of these situations in the context of design to these more general topics. My point in doing this is not that design conforms to some standard or principle to be emulated but that it is an example of a way of acting in which ethical considerations are implicit, whatever we think of the merit or otherwise of some of the particular decisions which designers take with respect to these considerations. In so doing I have suggested ways in which an understanding of the epistemology of design, and so of cybernetics, offers some insight into these particular questions of ethics.

2.2.1 Through the eyes of the other

The most demonstrable way in which design involves ethical questions is in the participatory character of the conversational epistemology of designing. While sometimes this is treated as if it is added onto designers' action, I've argued that it is implicit in design's conversational structure in two ways. Firstly, the conversational activity of drawing allows designers to incorporate dialogue with others within this process. Dialogue with others is a constituent part of the practical and epistemological activities of designing to the extent that it is an important aspect of designers' own action in learning about the situation they are designing in. Secondly, the conversational nature of drawing enables designers to act out the roles of absent others and so to involve them in the design process when, due to the asymmetry and wide impact of designing architecture, they cannot participate directly. Because the epistemology of cybernetics and design

incorporates the consideration of others in this way, it is both a way of acting which enables empathy and also one that requires empathy in order to be effective.[145] I don't mean that to design is to automatically be empathetic but that it is a way of acting which makes it possible to act empathetically whereas to act in terms of pre-determined rules or procedures tends to reduce our ability to do this. In this understanding, epistemology and the ethical consideration of others are seen as one action and there is no necessary conflict between my acting for myself and for others. While this perhaps seems rather optimistic, the significance of the analogy with design is that it demonstrates that this can be practiced, with at least some success, even in complex circumstances where the constraints of the situation are uncertain, where actions impact on others who cannot be consulted or even identified and where the differences between stakeholders are insurmountable.

This empathetic aspect of conversation in cybernetics and design can be summarised by the phrase used by von Foerster (1991) that we "see ourselves through the eyes of the other" (p. 73).[146] Von Foerster's use of this phrase is as an account of the nature of ethics: "where cognition computes its own cognitions through those of the other: here is the origin of ethics" (1976/2003, p. 267). Where two individuals observe each other, they observe themselves observing each other. This is recursive and has the potential to form an eigen-behaviour converging on some stable value or pattern of values which becomes common for both despite each constructing it separately. This offers an explanation, without referring to objectivity or authority, of how we form (and how we can form) stable concepts, "be they objects, concepts, languages, customs, rituals, cultures or whatever" (1991, p. 72) and to which we could add social and ethical norms. The significance of understanding these sorts of concepts to have been formed in this way is that, while we experience them as being commonly agreed (and so not merely a matter of individual preference in the sense of them being

[145] While Glanville (2004/2009), in his list of the ethical qualities of conversation, does not note empathy, it can be seen to be behind many of the qualities he does list (generosity, honesty, open-mindedness, respect, selflessness, sharing and trusting).

[146] According to von Foerster (1991, p. 71), the phrase originates from a conversation between him and Frankl. Frankl's (1946/1984) moving account of our personal responsibility, drawing on his experience in a concentration camp during the war, is a significant influence on von Foerster.

justifiable merely because I alone assert them), responsibility for them lies entirely with each individual and cannot be passed onto the social system of which they are a part (one cannot therefore blame society, convention or orders for one's own action). This understanding is, invaluably I think, in contrast not just to the objectivity of moral realism but also to both of the two poles of moral relativism—on the one hand, the understanding of ethical norms as being personal choices and, on the other, as being social constructions.[147] It is therefore a form of explanation in which we are both entirely responsible for ourselves and also inter-dependent with others without these two factors being in necessary conflict with each other.

As well as an explanation of how ethical norms are formed, this is also an account of how to practice ethics rather than morals. That is, it is where we see ourselves through the eyes of the other, and so in interdependent dialogue with the world, that we practice ethics (where we question what we should do) and where we do not, understanding ourselves as independent, that we practice monologue and so moralisation. One example of how this might occur in practice is given to us in Eagleton's (2007, pp. 171-175) metaphor of an improvisational jazz band.[148] Eagleton uses this example in order to suggest a way that we can see two common candidates for the meaning of the good life—love (understood as acting for the fulfilment of the other) and happiness (understood as acting for one's own fulfilment)—as being in unity with each other rather than in opposition (p. 173). The jazz band has no particular music to play. They are to improvise, to each express themselves freely; there is no right answer as to what to play, just as in life there is no given meaning or path to follow. However despite having no prior agreement over what to play or music to follow the musicians are not isolated individuals but instead interact with each other as a whole. Each of the players' free musical expression—their happiness or fulfilment—is the ground for the other players' free musical expression and so for their happiness and fulfilment. As it is the

[147] The first equivalent in epistemology to solipsism; the second to what von Glasersfeld (1989b, 1990a) has criticised as trivial constructivism.

[148] There is no particular connection between Eagleton and cybernetics other than such sympathies between his account and cybernetic ideas as I suggest here. The commonality could be traced to the idea of the good life as being both teleological and undefined. I have returned to this below in section 2.2.3.

fulfilment of others which is the ground in which we seek our own fulfilment, then to restrict others is to restrict ourselves as well (Eagleton, 2007, p. 168). The converse can also be added to Eagleton's argument: that to neglect our own freedom in favour of acting for the other can restrict them as well as us because it restricts us from contributing properly to the context in which they seek fulfilment (or in other words, one has a responsibility to others to act for oneself as well as a responsibility to oneself to act for others).

Eagleton's example is an instance of a reflexive cybernetic conversation.[149] Understood in terms of cybernetics, the actions of each musician are not just mutually supportive of each other but also reflect back on each other encouraging stable patterns to be maintained through this recursion and prompting explorative variation away from those patterns. One aspect of these different interactions is that they enable each musician to understand their own music through that of the others. This can perhaps seem an overly optimistic account given the many ways our individualities come into conflict with each other. Such reciprocal relationships are difficult to form and maintain and our relationships with others can often seem to be based in conflict.[150] A cybernetic account does not deny the conflict between individual viewpoints but instead understands it positively as the distinction necessary to drive a conversation and the otherness necessary to see oneself. Just as how, in Eagleton's example, it is important that each musician pursues their own improvisations

---

[149] That the metaphor of a jazz band can be understood as a cybernetic conversation is not surprising since Pask's early work was associated with jazz improvisation via the machine Musicolour (Pask, 1971; Pickering, 2010, pp. 317-321).

[150] As a counterexample, the account of human relationships given by Sartre, especially the section of *Being and Nothingness* entitled "The Look" (1943/1969, pp. 252-302), is in contrast to the reflexivity of the relationships in Eagleton's example and in cybernetic conversation (compare for instance Barnes, 2007, p. 81). For Sartre, our relationship with others (here he uses the example of looking at a passer-by in a park who returns one's gaze) is always a matter of conflict as we do not perceive them as merely another object in our world but as a subject perceiving us and so challenging our ordering and understanding of the world (Cox, 2006, pp. 44-46; Spade, 1996, p. 211-220). While Sartre's account does in a sense understand this as circularity, he views it as a vicious one because "the Other does not constitute me as an object for myself but for him. In other words he does not serve as a regulative or constitutive concept for the pieces of knowledge which I may have of myself" (Sartre, 1943/1969, p. 275).

rather than playing from some pre-defined score or copying what the others do, Pask (1980) notes that conversation depends on difference (on maintaining distinctions between participants) and too much uniformity dissolves the conversation. Yet are not the relationships between mutually interacting individuals as in the jazz band example too difficult to achieve in practice in most situations? Eagleton (2007, p. 174) himself regards his example as a utopian vision indicating a direction of travel rather than something necessarily achievable. However, the value of understanding this in terms of cybernetics is that it shows that the potential for such relationships is already present in familiar everyday interactions such as our everyday conversations with each other and our epistemology (and so, in a sense, in all our actions). The value of the analogy between conversation and design is that design demonstrates that such relationships are possible to achieve even in circumstances where relationships are asymmetric and where there is no common agreement over what our goals might be or over the nature of the situation we are in. This is not to argue that to design is necessarily to achieve such a relationship but that it is to act in a way where this sort of relationship is possible.

2.2.2 No right answers

The second of the three aspects of design that I am highlighting here as being related to ethical questions is that of there being at least some situations, such as wicked problems, which have no right answer in principle. This is an idea I have introduced at the very outset above, with respect particularly to radical constructivist epistemology, the responsibility which accompanies undecidability and the wicked problems which designers encounter. It is also implied by the sense of dialogue discussed in the last section, both in the sense that in dialogue I do not occupy a privileged or objective viewpoint and also that to finalise a solution is to terminate dialogue.[151]

The idea that some ethical questions do not have right answers is both a controversial and a familiar idea in the context of ethical philosophy. Normative ethics is the attempt to give such

[151] This is not to say that there are not situations where it is appropriate to terminate a dialogue but that if we want it to carry on then we need to avoid the sorts of actions that obstruct its continuation.

answers but is also most concerned with those dilemmas where there is no commonly agreed way to do so. In this section I look again at those two characteristics of wicked problems which are also characteristic of undecidability, that wicked problems have no right answers and no stopping rule, and examine these in the context of ethics.

2.2.2.1 Ethical dilemmas and wicked problems

There is a similarity between the characteristics of wicked problems and undecidable decisions and those of the dilemmas with which ethical theory is often concerned.[152] This is not to say that all ethical questions are wicked but that with tame questions in ethics being, by definition, easily solvable, it is the wicked ones in which we look to normative ethical theories for guidance. The ethical dilemmas which form common examples in ethical theory have many of the qualities of wicked problems in that they typically involve a series of conflicting or incomplete premises such that the question of what action to take is contestable. MacIntyre (1981/1985, pp. 6-7), for instance, describes a series of familiar contemporary moral debates which are characterised by the clash of contradictory positions which follow from premises that are in themselves reasonable but which are incompatible with each other.[153] Such situations are characteristic of modernity where we have come to realise, as Eagleton (2003, p. 229) notes with reference to Berlin, that we cannot agree on even the most fundamental of premises.

While unresolvable dilemmas are a common feature of ethical discourse, there is wide disagreement over their nature. Some see them as capable of being resolved (or at least that such resolution is possible in principle), whether by making their conflicting principles commensurable with each other (either through some form of consequentialist calculus, such as in utilitarianism, or through a unified conception of the purpose of human life, as by MacIntyre (1981/1985, 1988)) or by the application of moral rules discerned from rational thought or divine revelation. For others, such

[152] Note that the wickedness of wicked problems is not meant to imply any ethical wickedness, merely difficulty and complexity.

[153] See also MacIntyre's (1981/1985, p. 224) distinction between modern and classical forms of tragedy.

dilemmas are incommensurable in principle either because of a clash between objective values, as argued by Berlin (1988/1998, 1958/1998), or because values are merely arbitrary matters of choice, as for instance they are for Sartre (1946/1948, 1943/1969).

While wicked problems would seem at first sight to relate only to those positions in meta-ethics which understand ethical dilemmas as being irresolvable, this is not the case. While not all ethical questions are wicked problems, many wicked problems involve ethical content in that they involve others. It follows that even if one takes the position that it is possible to make ethical dilemmas commensurable there will be at least some ethical questions, those which emerge in wicked problems, which cannot be resolved for the same reasons that a wicked problem cannot be tamed (for instance that even if one knows how to resolve an ethical question, it is not clear in principle with a wicked problem what question is at stake). Most of all, wicked problems relate not just to individual ethical dilemmas but to the ethical dilemma of approaching such dilemmas as, similarly, choosing different ways of explaining the question at hand leads to different actions.

It is the purpose of normative ethics to offer guidance to us in such situations (we do not need guidance in those situations where we are not faced with some dilemma or other) and the difference between and significance of competing ethical theories is often shown on the basis of what they propose in such situations. However such theories are themselves characterised by disagreement—where what constitutes a good action according to one theory or principle differs from that according to another—and in such cases we must resolve the question ourselves. It may be countered that this is only an account of situations as we encounter them—that normative ethics is concerned with clarifying the nature of such situations or that normative ethics deals with questions of what is right in principle rather than practically what to do in some particular situation. Yet what guidance can normative ethics give if it is inapplicable in situations as we encounter them? That is, the idea of what is good conduct must refer to an action that it is possible to take. Like the design methods theorists who, in attempting to scientise design, produced theories of how to design which could only work given an implausibly complete description of the situation, such thinking assumes an unworkable objectivity.

Is to say that some situations have no right answers therefore to advocate a form of meta-ethical anti-realism, such as ethical nihilism (that nothing is ethically preferable to anything else), error theory (that all moral claims are false) or relativism (that ethical judgements are individual or social)? While this may seem to be the case at first sight it does not necessarily follow. While understanding an ethical question as wicked means understanding that there is no right answer to it, this does not entail that there are not still ideas of what might be good, bad or good enough and so this is not necessarily ethical nihilism or error theory. While relativism, the idea that the good is constituted by individuals or individual cultures rather than being universal, is a conspicuous manifestation of the idea of there being no objective right answer, it is nevertheless possible to also hold the position that some ethical questions have no right answers while understanding goods as being universal but in conflict with each other, such as in Berlin's objective value pluralism. Understanding ethical dilemmas as having no right answer therefore is not necessarily to be tied to a particular meta-ethical account. Similarly to radically constructivism, such a position can be maintained while, and follows from, remaining agnostic towards metaphysical (meta-ethical) questions, understanding them as being in principle undecidable.[154]

Von Foerster (1990/2003) saw ethical consequences in the undecidability of epistemology—that given my interdependence with the world I cannot claim my understanding to be true and so cannot be justified in insisting on it as being right. Whereas von Foerster traces this through from an epistemological starting point, the same argument can be used directly in an ethical context—that my ethical understanding is always *my* ethical understanding, always my responsibility, and I cannot appeal to any ethical principles independent of me because to do so is for me to give these their authority and this is therefore already to have taken these principles into my own hands. In contrast to the objective value pluralism of Berlin or to the relativism of, for instance, Sartre, it is possible from this position to remain ambivalent about the possibility that there are such objective ethical principles independent of me (perhaps, to name some common candidates, created by God, required by logic or an inherent property of the world, human nature or

[154] See also von Foerster's (1991, p. 63; 1990/2003, p. 291) association of metaphysics with undecidability.

of social interaction). This is the equivalent of the way that radical constructivism remains agnostic about the real world, as something in principle unknowable, rather than denying its existence. This has the advantage of avoiding the need to assert or reject any meta-ethical theory and so of differentiating the question at hand from the sort of unresolvable debates which lead only to clashing principles. Even given a realist meta-ethics (that is, even if I assume that moral principles exist independently of us), I can still never insist on an objective moral code to be corresponded to because I can in principle never adopt such a code independently of myself.

2.2.2.2 No right answers and normative ethics

There are broadly three approaches to normative ethics: deontology, consequentialism and virtue ethics.[155] Of these, the idea of a right answer is unavoidable in both consequentialist and deontological reasoning and it is noticeably difficult to practice either of these in the context of a wicked problem without taming it. In following deontological ethics I act according to my obligation or duty to follow a set of moral rules or codes. It is therefore wedded to the idea of a right answer and it is not clear how such an approach can be followed in the context of a wicked problem—how can I know what my duty is or which rules to apply if I can't define the situation I am faced with? Similarly to the context of design, because such situations are context dependent any predetermined rule will either prematurely tame the situation, require an endless multiplication of rules to deal with the specificity of each context or else be so generic as to give little guidance.

In a consequentialist ethics I act to achieve the "best" or "optimal" consequences. It assumes that I can weigh up the various benefits of different actions against each other and that these will be commensurable with each other in terms of some category—for instance "the greatest happiness of the greatest number" (Bentham, 1776/1891, p. 93) in the case of classical utilitarianism or agape love in the case of Fletcher's (1966) situation ethics. Although when compared to

[155] While it is common to use this three way divide in summarising normative ethics there are approaches to ethics that either combine elements from different approaches (e.g. rule consequentialism) or which are not easily defined in terms of these categories such as Gilligan's ethics of care, Levinas' ethics of the other and Dewey's pragmatic ethics. There are possible parallels between the position I outline here and that of these three thinkers which I have not yet fully explored.

deontological ethics this does not seem to be as committed to there being a right answer (the right action in a situation may vary with context given what its consequences are likely to be), it is nevertheless still based on the possibility of calculating and optimising one best solution. Given the above discussion of the limitations of optimisation in design, the difficulties that consequentialism faces in the context of wicked problems are evident. Given the heterogeneity of human purposes, they cannot be summed or reduced to one overall value to be optimised. Nor can we, in any case, see all the consequences of an action in order to make this sort of judgement, there being "no immediate or ultimate test" (Rittel, 1972, p. 393).

Both consequentialist and deontological approaches to ethics work well enough in tame situations where values are commensurable and can be summed or where the situation is so well defined that actions can be determined by rules in advance. However neither can give any guidance in a wicked situation without taming it. In this way they are parallel to the redundant attempts to codify design into rules or as a process of optimisation and are unworkable in most of the situations which designers encounter.

In addition to the tendency of deontology and consequentialism to treat wicked problems as being tame, it is possible to add a second challenge from the point of view of the epistemology of cybernetics and design. Consequentialism places the ethical weight of an action on its consequences whereas deontology places it on the act itself and its intentions. For consequentialism, the intentions behind an act do not come into the ethical equation and an act which had unintentional good consequences is a good act regardless of its motivations. For deontology, the consequences of an act are by contrast not part of how it is to be ethically judged—an act which had unintentional bad consequences but good motivations is still a good act. The desire to locate goodness in one part of the action (its intention, its consequences) comes from a desire to be definitive, to make a judgement in complex cases which gives us precise guidance. If, though, we understand these situations not as isolated actions but in terms of cybernetic circularity, and so as on-going processes, we can see both the consequences and the intentions of an action in relation to each other. In a conversation the consequences of an action are fed back to the next performance of the action itself in such a way that these cannot be separated from each other. It is by observing my present and

past acts that I act again (and improve how I act) and by acting that I explore and give myself something to learn from. This is a different way of looking at what an action is and implies understanding ethical questions in terms of a continuing process rather than as a set of fixed (moral) judgements. This does not give us the comfort of a definite answer or moral code to follow but leaves the responsibility with us (that is, there is no stopping rule).

Understanding this as a process emphasises how our deliberation over conduct (that is, ethics) is itself a matter of conduct (that is, something to which ethics applies). This leads to the ethical question of how we can reason about ethics in a manner which is ethical (here in both the senses of "ethical"—as being a way to reason about ethics which is, firstly, ethically good and which, secondly, makes room for ethical considerations within it). It is this question that I see as the context of von Foerster's distinction between morals and ethics.

The third of the three main approaches to normative ethics, virtue ethics, is somewhat different in terms of its relation to wicked problems. Virtue ethics understands the good in terms of character (the virtues) and good actions are ones that develop or exhibit good character traits. Virtue ethics is therefore not tied to making particular judgements about the right course of action in some situation. This has been a source of criticism—that virtue ethics does not provide clear moral guidance (see for instance Louden, 1984/1997, pp. 205-206) yet this seems appropriate in the context of situations which in principle have no right answer. This is not however to make an argument for virtue ethics as opposed to other approaches. While consequentialism and deontology are committed to the efficacy of optimisation and of rules respectively, it is still possible to speak in terms of consequences and intentions in the context of wicked problems but just not in such a way that these give conclusive justifications for action. Louden (1984/1997, p. 216) criticises virtue ethics as repeating the tendency of consequentialism and deontology to reduce ethics to one single system and proposes that, instead of trying to reduce one scheme to the other, we investigate how they may be coordinated. Such an attitude is reinforced by a consideration of the characteristics of wicked problems where, as Rittel (1972) pointed out, how we define the problem defines the solution—if we characterise the question variously in terms of character, duty or consequences then we shall answer it accordingly in those terms. Given the characteristics of wicked problems we

should not necessarily expect there to be a way of making these different considerations commensurable with each other and a pluralism of approaches seems appropriate—that we consider the consequences *and* the intentions *and* the virtues we develop in our actions. These are not commensurable approaches and so cannot be made decidable—and so the responsibility ultimately lies still with us.

2.2.2.3 No stopping rule

The third aspect of wicked problems which I wish to highlight is that, as Rittel (1972, p. 392) noted, because they have no right answer, they have no stopping rule and so cannot be answered in a way that cannot be questioned further. In normative ethics, a lack of certainty such as this is usually thought of as being problematic as it is the aspiration of most ethical theories to provide clarity and to not do so is taken to imply the arbitrariness of nihilism or relativism. This is in contrast with how a lack of certainty is understood in the context of designing architecture, where it is not just something to be expected but also a way in which design can be characterised and, in a sense, a requirement for design to be possible (when we are certain about what to do, we are not designing).

While these different attitudes are perhaps not surprising, given that they occur in different contexts, they are related because designers are dealing with ethical questions in their practice. The attempt to bring the certainty of any normative ethical theory to design cannot work because, as we have seen, designing architecture, being concerned with wicked problems, cannot be successfully codified into rules (deontology) or reduced to one value to optimise (consequentialism).

What I find important in suggesting this connection is how, whereas in normative ethics a lack of certainty implies arbitrariness, design steps outside of this dichotomy. This quality is an aspect of design's conversational epistemology. Though the design process may well begin arbitrarily (for instance by making a mark in a sketch) such a beginning does not entail arbitrariness because the circularity of the process enables this beginning to be considered and developed. While this generates a plurality of viable options to be chosen between, these are not merely to be picked arbitrarily but can be developed and justified through a continuing dialogue with others and with the situation. The need to make and justify such choices, and to do so continually, is a form of taking

responsibility. When contrasted with a designerly approach to justification such as this, it is the claim to objectivity, that a particular set of principles or criteria are true or best, that is arbitrary because it relies on this one initial assertion for everything.

The circularity of designing is not just a way of improving one proposal but of learning about the situation in which it is made in order to find both new proposals and new ways of evaluating them. In this way, designers treat such questions as having no stopping rule and in so doing remain open to the possibility of new criteria which might unsettle existing standards or practices.[156] To act in this way is to be concerned not with how a situation can be resolved (for instance, how consensus is reached amongst a group of people as to what to do) but how a conversation can be sustained so that there remains the possibility of acting in different ways.

2.2.3 Intrinsic and extrinsic purpose

The third of the three ideas that I highlight here relates to the ideas of a *telos* or goal and teleology or purpose, a central theme within both cybernetics and ethics and one which I have introduced above in terms of the ambiguity of architecture's purpose in relation to that of our own. While the first two ethical ideas which I have highlighted above, that of seeing through the eyes of the other and of there being no right answer, imply each other (it is in dialogue with others that we understand our viewpoint as not being an objectively privileged one; it is because we do not occupy a objectively privileged vantage point that we engage in dialogue), both are implicit in the nature of purpose as it is understood in second-order cybernetics.

Purpose, understood as behaviour oriented towards the achievement of a goal, is a foundational theme within cybernetics being implied in and enabled by the central cybernetic concept of feedback as described in Rosenblueth, Wiener and Bigelow's (1943) proto-cybernetic paper "Behaviour, purpose and teleology" (see also von Glasersfeld, 1990b). Teleology, and the associated Aristotelian idea of final causes, had long fallen out of favour in scientific discourse and

[156] There is a similarity between what I suggest here and the pragmatic ethics of Dewey.

had been replaced instead by a purely mechanistic (that is, a deductively mechanical) and so objective account. One significant aspect of cybernetics is its reintroduction of purpose to scientific thought. As von Foerster (1990/2003) put it:

> We are all cyberneticians (whether or not we call ourselves such) whenever we justify our actions without using the words "because of…," or "à cause de…," but with the phrase in English "in order to…," which in French is much more Aristotelian, "à fin de…" (p. 298).[157]

There are two aspects of Rosenblueth et al.'s (1943) account of purpose which are somewhat confusing in their presentation (especially when compared to the later account of second-order cybernetics), as for instance criticised by Taylor (1950a, 1950b). I shall outline these briefly here not so much in order to clarify this early paper but because they reveal the significance of a distinctly second-order cybernetic understanding of purpose. The first follows from the way that "purpose" can be taken both as a synonym for goal and also as the way of acting towards that goal. The examples which Rosenblueth et al. (1943) cite as non-purposeful (a clock, roulette wheel, a gun) while not exhibiting "intrinsic purposeful behaviour" (p. 19) in the same way as a servo-mechanism, can be said to be a purpose in themselves (the goal of their designing and making) and can also be used purposefully. These terminological distinctions are the source of Taylor's (1950a) first criticisms and are clarified in Rosenblueth and Wiener's (1950) response.

The second ambiguity is more substantial and concerns the nature of a goal. Rosenblueth et al. (1943) defined purpose as follows:

> The term purposeful is meant to denote that the act or behaviour may be interpreted as directed to the attainment of a goal—i.e., to a final condition in which the behaving object reaches a definite correlation in time or in space with respect to another object or event. (p. 18)

---

[157] Rosenblueth and Wiener, in their response to Taylor's (1950a) criticisms, clarify their position as not implying a philosophical belief in final causes (Rosenblueth & Wiener, 1950, p. 326). As Stewart (1959/2000) notes, the idea of circular feedback removes the problem of final causes somehow occurring after their effects.

Taylor (1950b) shows that such a conception of purpose as striving towards a definite final condition does not account for vaguer or unsuccessful activities that are still goal-directed although no goal exists—"a man groping about in the dark for matches which are not there, but which he erroneously believes to be near at hand" or alternatively how "the alchemist can seek the philosopher's stone, the knight can seek the Holy Grail" (Taylor, 1950b, p. 329). While one could answer Taylor's criticism in a variety of ways,[158] there is a sense in which it anticipates the conception of purpose as understood in second-order cybernetics—that the goal of the target-seeking torpedo, to use Rosenblueth et al.'s (1943) example, is not the ship itself, or even the "apparent focus from which the sound waves emanate" (Rosenblueth & Wiener, 1950, p. 321), but of being on course for the ship. Understanding purpose in this sense, the behaviour of the torpedo can be described as purposeful even if the chase goes on indefinitely and there is no final condition, a description which could equally be applied to the knight's quest for the Holy Grail, the alchemist's for the philosopher's stone or the search for absent matches. This is notably the sort of purpose which designers have in their designing, as it is not possible to specify the conditions at which designers' action is aimed in advance (see discussion of wicked problems in section 2.1.1 above).

Both these issues in this early paper point to what would be the central observation of second-order cybernetics—the inclusion of the observer in the act of observation and the understanding of purpose and control not as properties of one part of a system but as belonging to the system as a whole.[159] It is the maintenance of the course that allows a destination to be pursued and indeed to be changed. The purpose of steering, as understood in a second-order cybernetic account, is thus to be in control of the ship's course in response to changes in the

[158] For instance, that the goal is that constructed by the observer rather than something objective and that purpose is to be taken as an explanatory principle rather than an account of the real world.

[159] Understanding purpose to be a property of the system, the purposeful use of what Rosenblueth et al. (1943) call non-purposeful machines has the same feedback structure as that intrinsic to a servo-mechanism. See also Bateson (1972/2000, p. 491) and Negroponte (1970, 1975) on dialogue between computers and their users, as discussed above (see section 2.1.2).

environment rather than to reach some destination and the goal of an action is therefore intrinsic rather than extrinsic to the act itself.

Teleology is also a common term in ethics and it is possible to speak about a teleological ethics in different senses. On one hand, there is the sense of teleology in the Aristotelian tradition and also of its recent revival in virtue ethics by, for instance, Anscombe (1958), Foot (1978/1997) and MacIntyre (1981/1985). On the other, there is that of consequentialist ethical theories such as utilitarianism.[160] The sense of teleology, *telos* and purpose in each of these is very different. In the *Nicomachean Ethics*, Aristotle defines the good as the goal at which all things aim (I.1) and goes on to argue that the ultimate human good or goal be understood as that of *eudaemonia* (I.7), usually translated as "happiness", "the good life" or "human flourishing".[161] Following from this, the Aristotelian tradition, together with its modern counterpart virtue ethics, is concerned with understanding the nature of the good life and with how it could be practiced and so with purposeful action towards this overall goal. In contrast to this, consequentialism understands an ethical action as one which maximises its good consequences according to some way of weighing competing priorities against each other. The difference between the two concepts of teleology is over the relation between the action and the goal at which it is aimed. In consequentialism the goal of acting is understood as extrinsic to and independent of the action itself and any means is therefore justified if it achieves the greatest good overall. In virtue ethics the goal of an action is intrinsic to and inseparable from the action itself.[162]

---

[160] As MacIntyre (1981/1985, p. 62) notes, utilitarianism can be understood as an attempt to create a new teleology to replace the traditional Aristotelian one so that moral concepts could retain certainty and universality in the absence of that tradition, while deontology can be similarly understood as the attempt to replace categorical divine law with similarly categorical rules devised through reason (see also Anscombe, 1958).

[161] Happiness is not an ideal translation, as MacIntyre (1966) notes, as the Greek term "includes both the notion of behaving well and the notion of faring well" (p. 59).

[162] Similarly for von Foerster (1990/2003, pp. 290-291), referencing Wittgenstein (1921/1974, 6.422), ethical reward and punishment must reside in the action itself. It is worth noting that Anscombe, whose (1958) paper marks the beginning of the revival of virtue ethics, is known for her work on Wittgenstein.

While the extrinsic nature of the good in consequentialism opens it up to criticisms, such as those of Anscombe (1958), the intrinsic nature of the good in virtue ethics leaves it with a problem of definition. Whereas in the classical conception of virtue ethics, the idea of the good life was established by tradition and was easy enough to conceive of given the context of a society with little plurality, in the contemporary situation it is difficult to define either the good life or the virtues. Although MacIntyre (1981/1985) does attempt to answer this question in his account of social practices and roles, he can only define the good life self-referentially: "the good life for man is the life spent in seeking for the good life for man"; that is, as a form of "quest" (p. 219).[163] However, while such a definition can seem underwhelming, a comparison with the understanding of teleology in cybernetics is illuminating. In discussing Rosenblueth et al. (1943) I noted that there were two different ways that the goal of the steering of the ship could be described—firstly as the port to which it is travelling, secondly as being on course for the port. In the former the observer and goal are considered extrinsic to the system; in the latter the observer and goal are intrinsic. Similarly we can understand the teleology of consequentialism as being concerned with extrinsic goals and that of virtue ethics with intrinsic goals. The lack of specificity in MacIntyre's definition, and the lack of specific moral guidance for which virtue ethics has been criticised (Louden, 1984/1997, pp. 205-206), can in this sense be seen as essential—the definition of some specific final end (a stopping rule) would result in the termination of the circularity, and so of the self-reference, and the end of the possibility of pursuing intrinsic goods.

In a cybernetic understanding, a goal might not just be intrinsic to an action (where the good it aims at is a quality of the action itself) but also reflexive, where the action reflects back on, and acts on, the action itself—that is, where through feedback I use the consequences of my action to improve how I act again (a form of error correction). Because in this case the action acts on itself,

---

[163] This definition leaves MacIntyre open to the sort of criticisms of liberal pluralism advanced by Eagleton (2007, p. 50). While Eagleton's comments are not specifically aimed at MacIntyre, he responded with these when I asked him about MacIntyre's definition after his talk at the Hay Festival in 2007. From a cybernetic understanding of purpose however, the idea of the good as a form of quest is compatible with Eagleton's jazz band example.

the goal is continually being revised and cannot be defined except in terms of this reflexivity—hence understanding the goal of life as being the good life.[164]

This is not to say, however, that if teleology is understood as intrinsic, that it will not also involve extrinsic goals or that we must choose between these two sorts of goals. Indeed it is the pursuit of the intrinsic goal of being on course that allows the extrinsic goal of the port (and other alternatives) to be pursued, while it is the journey to the port that gives the intrinsic goal of steering its relevance and context (see also MacIntyre, 1988, p. 35). This can be compared with conversation theory—where while the obvious goal is (the extrinsic one) to learn about and communicate the topic, this goal enables us also to learn about the other participants and also about oneself (Barnes, 2007, p. 81) which in turn is what allows us to pursue the topic.[165]

This returns us to Eagleton's metaphor of the jazz band, and so to dialogue, where the purpose of the band is intrinsic to its action in the sense that part of the purpose of the playing is the playing itself. As Eagleton (2007) notes, such an idea of the meaning of life is therefore curiously close to meaninglessness as in order to be an end in itself it must need no justification beyond itself

---

[164] See also MacIntyre's (1981/1985, pp. 56-61) point about functional concepts.

[165] One complication of this is that what goals one considers as intrinsic or extrinsic to an action depends on how we choose to define the extent of the system under consideration, which we can do differently depending on what we are trying to explain. While this means that the same action can be explained in terms of goals internal or external to it, this does not mean that this choice of explanation is neutral. Whether we explain our goals as being external or internal to our action leads to us placing value differently in the situation and so to different ways of acting (such as the contrasting courses of actions suggested in the same circumstances by consequentialism and virtue ethics). This is related to but doesn't correspond to the distinction between first-order and second-order cybernetics as the relation of a goal to us is a matter not just of whether we are including ourselves in our considerations but also of the nature of the goal and of what aspects of our action we are considering. Understanding the intrinsic or extrinsic status of a goal in this way means that, unlike MacIntyre's (1981/1985, p. 187) loosely argued attempt to separate certain activities which involve internal goods from certain others which do not, the question is more about our own relationship to whatever activity it is with which we are engaged (and indeed along the lines of MacIntyre's own chess example; p. 188). This raises the question of whether there remain some goals, such as for instance money, which can only ever be external to a practice. This question, and its consequences in ethics, is beyond the scope of my present study.

(p. 174). Another possible example is that of the relationship between a tutor and student in design education. This is a less utopian example to take as there is an asymmetry to the relationship and the external pressure of examinations and qualifications to be considered (pressure which applies to the tutor as much as the student).[166]

In the context of design education, the tutor-student relationship is characterised by conversation, such as, for instance, the one which Schön (1983/1991, pp. 79-93) takes as his major example. The overall goal of this relationship is, like the jazz band, intrinsic to it. That is, the overall goal is not the external one of the grade or even the qualities of project but the learning that is achieved through it. In teaching design therefore it doesn't help to just assist with the project.[167] There is a balance to be struck—to give too much guidance can obfuscate the student's own capacity to explore and learn but to give too little can be to leave a student working in a way which is ineffective or unchallenging. The question of how direct to be is bound up with the strengths and weaknesses of an individual student and when first working with a student it can therefore be difficult to know how to advise them. There is a sense, then, that teaching is also learning as the tutor must learn how to teach each student—to understand what holds them back, what might be productive to challenge them with and how they are likely to respond to what is said.[168] Likewise the student must learn not just about their subject and project but also how to be taught—what and how to present to the tutor so they will be able to assist and how to interpret what is said. There is also a sense in which the student can teach the tutor how to teach them by helping the tutor to learn about their particular ways of thinking and learning. That is, in order to pursue the goal intrinsic to their relationship, rather than only the extrinsic ones of the project and grade, both the student and tutor must learn to see themselves through each other's eyes in order to learn how to

---

[166] The relationship between tutor and student is one I have been on both sides of, having taught design studio on several undergraduate architecture courses during the research period of this thesis.

[167] I refer to the teaching of design specifically as I can draw on my own experience of this; however, what I suggest is, I think, generally applicable to education.

[168] Compare Pask (1975b): "there is no theory of learning apart from a theory of teaching; no theory of teaching apart from a theory of learning. There is a theory of teaching and learning together and that is all" (p. 33).

act. This process of learning about the other in design education, conducted through an ongoing conversation where the tutor plays the roles of multiple others, is a form of preparation for the more complex conversations with others that are so important (in both practical and ethical terms; see above section 2.1) in practice.

2.2.4 Summary: The ethical relevance of the cybernetic epistemology of designing

I have noted some of the ways in which the epistemology of design relates to ethical considerations. These have included: (1) the similarities between the wicked problems which designers commonly encounter and those questions in ethics which remain dilemmas; (2) the asymmetry of the relationship between designers and those they design for; and (3) the relationship between the purpose of architecture and our purposes in using and designing it. These are instances of wider questions about the nature of ethical deliberation, about our relations with others and about the nature of purpose and suggest ways in which the epistemology of design, and so of cybernetics, has something to contribute to ethical thinking in general. I do not mean this in the sense that the example of design provides us with ethical rules to follow but that its example clarifies some aspects of these questions. This contribution can be summarised in the following three points.

Firstly, that there are at least some questions with ethical content that have in principle no right answer is a challenge to the idea of normative ethics. Leaving aside the unanswerable question of whether this applies to all ethical questions, this is the case for at least some ethical situations as many wicked problems contain ethical content. In particular, I have argued that, with wicked problems, deontological and consequentialist forms of ethical reasoning are impossible to apply as they depend on taming the situation (in the same way as with attempts to systemise design methods in terms of rules or optimisation). It follows that moral rules or calculi cannot be universally applicable because they do not work with wicked problems and so with many of the ethical questions that arise in design. I have suggested that this provides a possible explanation of the commonly held limitations of deontological and consequentialist approaches to ethics and, given this, adapting or combining these (e.g. rule consequentialism) will be futile in the case of wicked

problems. This raises the question of arbitrariness and so the possibility of nihilism or relativism. The example of design, however, demonstrates that acknowledging there being in principle no right answer to some situation does not necessarily lead to arbitrariness but instead to responsibility, whereas it is the attempt to resolve such a situation definitively which is an arbitrary act.

Secondly, that, while the sort of reflexive dialogue with others which is suggested by von Foerster and Eagleton seems overly optimistic, designers practice something similar even in trying circumstances (with asymmetric relations to others; in the context of wicked problems) where dialogue seems impossible. This sense of dialogue is even implicit in the act of drawing, where designers attempt to look through the eyes of those they design for, and so even the sorts of conversations which designers have with themselves are participatory in a sense. The example of design emphasises the participatory quality of the epistemology of cybernetics where our acting for ourselves and for each other are bound together reciprocally. This is not to say that to act as a designer is necessarily to act in a good way towards others but that to act in terms of the epistemology of design is to act with respect to one's relations to others and so in terms of ethical questions, whatever the merits of the particular action taken.

Thirdly, that while the sort of reflexive dialogue with others which is implicit in designing is in part concerned with pursuing goals external to it, it is the internal goal of sustaining such a dialogue that allows such external goals to be pursued. Where we act only in pursuit of external goals, when we achieve them we are not left with further goals to pursue and this can be to terminate our dialogue with others and with ourselves. Where we pursue goals internal to our action (for instance, how to improve whatever it is that we are doing) these will always generate new questions even if it is just how to respond to changes in our circumstance. This is not to say that the internal and external goals of an action are to be understood as being in conflict with each other. These two sorts of goals are related in that we can pursue an internal goal through a series of external ones (for instance, where the internal goal of steering is to learn to steer well and so to keep on course, we can pursue this goal by sailing towards a particular destination) and it is the internal goals that allow external ones to be pursued (for instance, that I can maintain a course is what allows me to travel to somewhere in particular).

PART III—Being part of the world (2): spatially, architecturally

Introduction to Part III

Whereas in Part II I have been concerned with the epistemological and ethical aspects of our being part of the world, in Part III my point of departure is that of the spatial sense of this idea and with ways that our experience of this can be heightened architecturally. Part III therefore does not follow consecutively from the conclusions of Part II but instead returns to the beginning of the preceding discussions of epistemology and ethics to pursue a parallel investigation of our being part of the world (indeed these two investigations have been undertaken in parallel rather than consecutively).[169]

I have undertaken this investigation through a number of design projects that I present here as two design inquiries. The starting point for the first has been my appreciation of the physical traces that our everyday activities leave behind (e.g. Figure 16-Figure 19; see section 3.1.1 below). These traces form indexes of our presence in a place—that is, they remind us of this because we see a causal (indexical) connection between the marks and our making of them.[170] In the first group of projects (Allotment Calendar, Toast Rack, Staircase Clock, St. Alphage Gardens) I have proposed devices for particular everyday situations that would undertake similarly indexical processes emphasising our presence in a place. These projects sit in the context of the relation between architecture and the measurement of time, such as, for instance, in the design of town clocks or astronomical devices (some examples include those given in Book IX of Vitruvius, the Pantheon in Rome, the Jantar Mantar in Jaipur, St. Mark's Clock Tower in Venice, Denari's Solar Clock (McCarter, 1987, pp. 22-25)). This sits more generally in the context of architectural concerns with both permanence and decay (see for instance Harries, 1997, pp. 228-252). In constructing these indexes,

[169] While I have sometimes tried to develop or argue for specific architectural strategies from the preceding epistemological and ethical position (for instance Sweeting, 2007) I now see any attempt to do this as self-contradictory.

[170] The index is one of the forms of sign described by Peirce (1868/1992, 1894/1998) who distinguished it from those which communicate via convention (a symbol) or through resemblance (an icon).

one common feature of these projects is their performance of mechanical translations. The automatism of this is in contrast with many other aspects of how I have approached the projects where my decision making has been more personal. This is particularly the case in terms of my choices of sites which have all been places taken from within my own everyday experience and the qualities of these sites, which, being everyday situations, are concerned with the personal and the contingent. The regularity of the translation mechanisms has some sympathy with the repetitious quality of these everyday situations (such as in the rhythmic everyday descriptions of Perec, 1975/2010) but also contrasts with their contingency and unpredictability. Similarly to my comments on the Contingency project above, I see the apparent objectivity of the translation mechanisms as emphasising the contingent nature of their context through their contrast with it.

Although the second group of projects (Café Bohemia, Hackney Churchyard) contains some similarly indexical elements, these projects shift in emphasis from our presence in the world to the presence of the world around us. My starting point for this investigation has been with ideas of the common qualities of our experience of space and the tradition of articulating this in architecture as discussed in the accounts of Harries (1997, p. 125), Norberg-Schulz (1971, pp. 17-27; 1975, p. 430) and Vesely (2002, 2004, 2010) which I have introduced above. I regard some aspects of this second investigation as something of a misstep on my part but one on which I have nevertheless managed to reflect in a way which I have found useful (as I discuss below in section 3.2.4).

All these projects are concerned with architecture's capacity for communication. In this they relate in various ways to the epistemological discussions of Part II. Whereas above I have mainly been focused on the epistemology of designing architecture, in investigating aspects of architecture's communicative qualities I have been concerned with the epistemology of observing architecture and with how this relates to the epistemology of designing. In considering architectural communication there are also various parallels with the ethical discussions above and particularly with the idea that architecture can be thought of as communicating an ethos. This, I have found, creates contradictions between the idea of our being part of the world and some of the architecture I have proposed in order to articulate this. One aspect of how I have come to see the relation between Parts II and III is in exploring the difficulties of some of the ideas of Part II when it comes to

proposing architectural projects, such as trying to avoid the appearance of realism or truth in architectural communication. While I have noted these epistemological and ethical parallels and contradictions where they arise, I have here concentrated for the most part on presenting the design projects and have returned to these intersections below in Part IV.

3.1 Indexing our presence in the world

3.1.1 Indexing the everyday

My starting point for the projects that I present in this section is my appreciation of those situations where everyday processes leave behind indexical traces. I find the places where this occurs moving as they prompt me to consider my presence in that place and within the world. The most obvious examples of such situations are those where the indexical process is a physical one, such as the sorts of patinas created by the wearing-away of a surface through its use or weathering (for example, the wearing away of the steps at Wells Cathedral or the formation of paths through a field; Figure 16-Figure 18). As well as these physical traces, one can also speak of indexes in more abstract senses: a city embodies its history in its street patterns and built fabric;[171] traditional vernacular architecture follows from conditions of climate, materials and technology; and the typical situations of the everyday reflect the spatial and climatic conditions in which the culture of which they are a part has developed. In each of these different situations what is special is the sense of connection they create—of how we have affected the world and how it has affected us. Noticing the formation of a path I see my effect on and connection with the field; in viewing the steps at Wells or historic forms in a city I can see my present action in continuity with that of others in the past; where I see the relation between a typical everyday situation or vernacular tradition and its context I notice the effect of this context on me. Whereas everyday activities are largely transitory and fleeting, where they leave traces they are embodied in something and so become observable allowing us to notice what would otherwise go unnoticed. Similarly, it is where the intangible narratives of history or conditions of space leave a tangible residue that we become most aware of them.

[171] I think especially of Rome and examples such as the Basilica of San Clemente where one descends below the street level basilica of the middle ages, dating from the late C11th and early C12th, through a C4th Basilica which now forms a crypt to the church above, and below again to remains from the republican era including a Mithraeum. While such examples are particularly rich, any city other than a recently founded one can be thought of in this way.

One thing that fascinates me about these indexical situations is that to replicate the qualities of the recording directly is to create something different to where it has accumulated over time. If we try to do so we create the image of a connection only: pre-distressed materials or fake vernacular styles. While these may sometimes be convincing replicas and, in any case, have interest in their own terms, they are something different, being the simulation of a connection rather than the outworking of one. It is not the qualities of the indexes themselves that are important but how they have been formed and that the process of their formation is discernible.

In the projects which I present in this section I have suggested ways in which similar situations to these examples could be created in a more immediate way by using technological automation to form accelerated versions of the indexing process. There are significant differences that follow from this initial move. Whereas part of the interest of all such situations is the slowness and tangibility of the process, the use of technology means that the sense of the history they record will be much more immediate and the indexical process itself less tangible. Given that the indexation in the projects is to be accomplished through automated sensors and mechanisms, the projects sit in the context of responsive or interactive architecture and so also, more broadly, in the context of the relation between architecture and machines, and this is one aspect of them on which I reflect below (see section 3.1.4.4).

There are four projects that I have featured in this section. The first, Allotment Calendar, and the last, St. Alphage Gardens, are the most substantial both in terms of the development of the project and also the discussions that they generate. The other two (Toast Rack, Staircase Clock) are much simpler, consisting of only a few drawings or sketches in each case, and are in many ways responses to the Allotment project and my discussion of it; I have therefore chosen to group them together and to reflect on them as a pair.

Figure 16: Goal posts, abandoned football pitch, Cefn-y-Bedd, North Wales.
The path visible in the photograph had originally been worn where the crowd stood on the edge of the pitch but was subsequently maintained only by the footfall of local dog walkers (including me). It gradually changed form, curving around the now abandoned goalmouth.

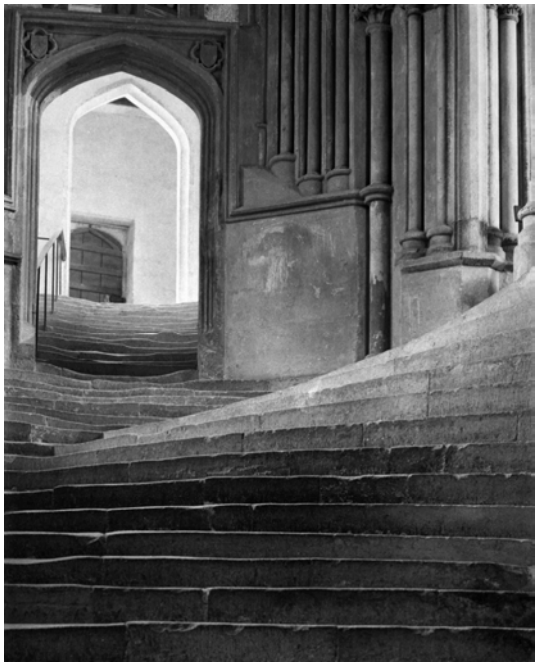

Figure 17: Stone staircase, Wells Cathedral.

Figure 18: Stone staircase, Wells Cathedral.

Figure 19: Rome, *Via delle Botteghe Oscure* (Street of Dark Shops).
Adjacencies between different eras, a city as an index.

3.1.2 Allotment Calendar

3.1.2.1 Visiting Llyswen

An allotment is an example of a situation where it is possible to see a history of one's action in a place's physical and visual character. It is through one's regular effort that it is transformed, both in the sense of the direct physical mark making of, for instance, digging over a row or harvesting a crop and also in the growth of the plants that one tends over the year. This was therefore a relevant site to explore given my interest in the traces of our action in the world.[172]

Llyswen is a small village in the Welsh borders near to Hay-on-Wye. My connection to the village is via a friend whose father, Tony, has an allotment there (see Figure 20-Figure 22). The allotment is set not amongst others but on its own within the garden of the house of Tony's cousin, Rosemary. The house and garden have been owned by the family for over 100 years and Tony has memories of his childhood there. Located a twenty minute drive from Tony's house, he would travel there several times a week to tend the allotment and to see his cousin. I spent time there on a couple of occasions, helping to pick rhubarb and to plant runner beans which I consumed on another visit later that year.

I made several initial drawings of the allotment in terms of my own visit to it and of Tony's regular activity there (Figure 23-Figure 25). I chose to compose these drawings in terms of the duration of and intervals between these visits rather than in terms of physical or visual properties because time is, in several senses, the significant context of an allotment. This temporal context comprises a mixture of the cosmological—the changing of the seasons and the corresponding changes in the length of daylight—and the everyday—the time spent working there (which is perhaps as much about fresh air and exercise as the produce which this work creates) and how this fits into the rest of the day and week. As well as affecting the growth of the plants through the amount of sunlight with which to photosynthesise and the occurrence of frost, the seasonal changes

[172] For my first account of this project, see Sweeting (2009).

also affect the hours that can be worked, what work is to be done and when that work is possible. As well as these daily and seasonal rhythms, there is also the relation between one year and the next, with what was planted previously affecting what is to be planted next due to the effect on the nutrients in the soil. In these first drawings I developed a way of representing the year in terms of daylight, drawing a series of lines one for each day of the year in proportion to the time between sunrise and sunset on that day (Figure 24, Figure 25). Within this I marked events and their durations, such as trips to the allotment by Tony as well as my own visit.[173]

[173] Some I knew about precisely, some I interpolated. These drawings therefore were not an exhaustive documentation but do look something like one would have looked if I had recorded more data.

Figure 20: View towards allotment from top of steps.
Note the trodden down grass forming the path between the steps and gate at a slight angle to the house. Tony and his daughter Clare can be seen in the distance, planting runner beans.

Figure 21: View from allotment towards Rosemary's house with Tony in the foreground, planting runner beans.

Figure 22: Location plan, Llyswen village.
1. Rosemary's house. 2. Rosemary's garden and site of proposed Allotment Calendar. 3. Tony's allotment. North is up the page. Note that subsequent drawings have been oriented to the layout of the calendar rather than to north.

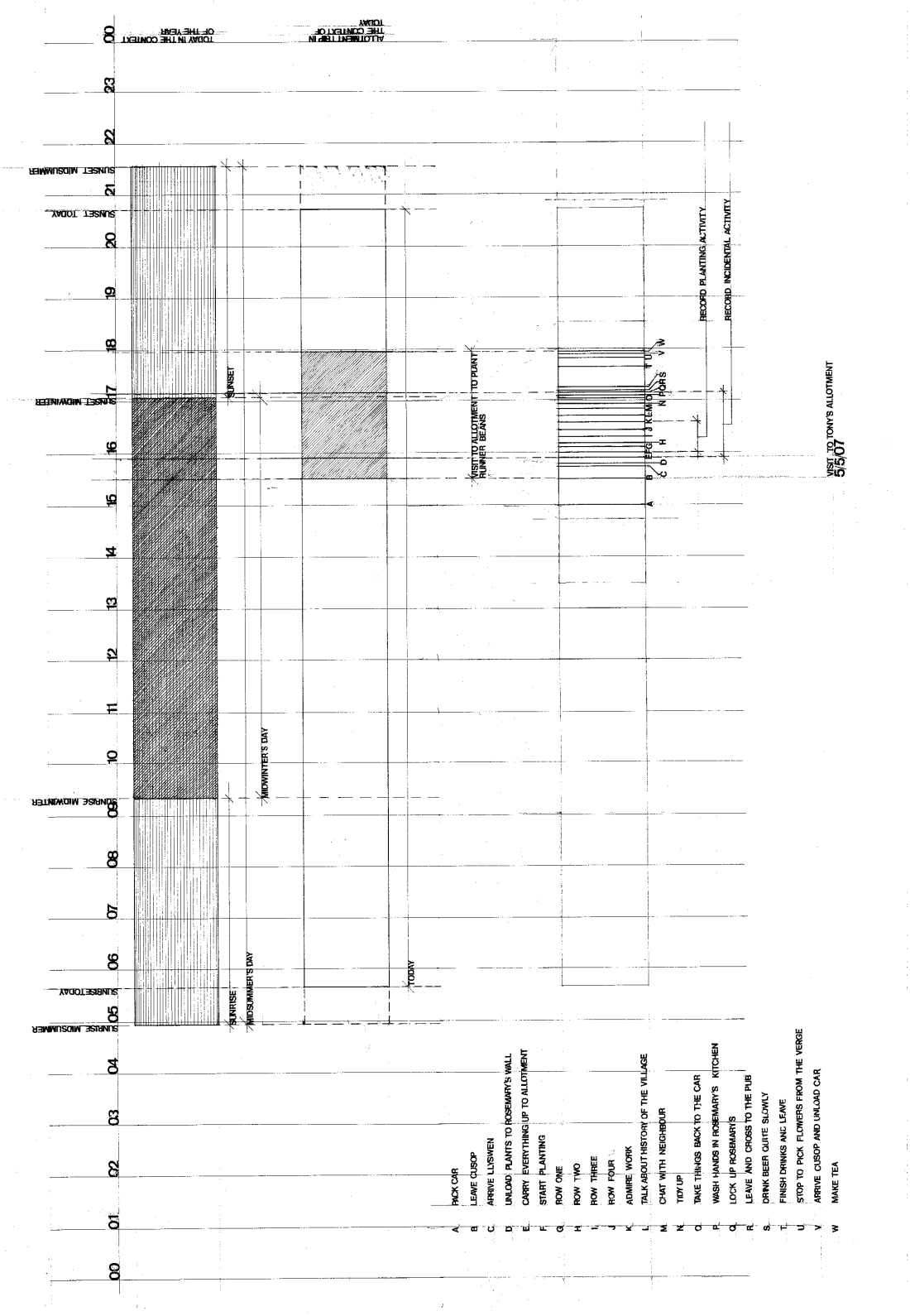

Figure 23: Recording of the timings of my first visit to the allotment.
I have placed the various events of that visit (including planting the rows of runner beans but also making tea and so on) in the context of the length of daylight that day and the shortest and longest days as a comparison.

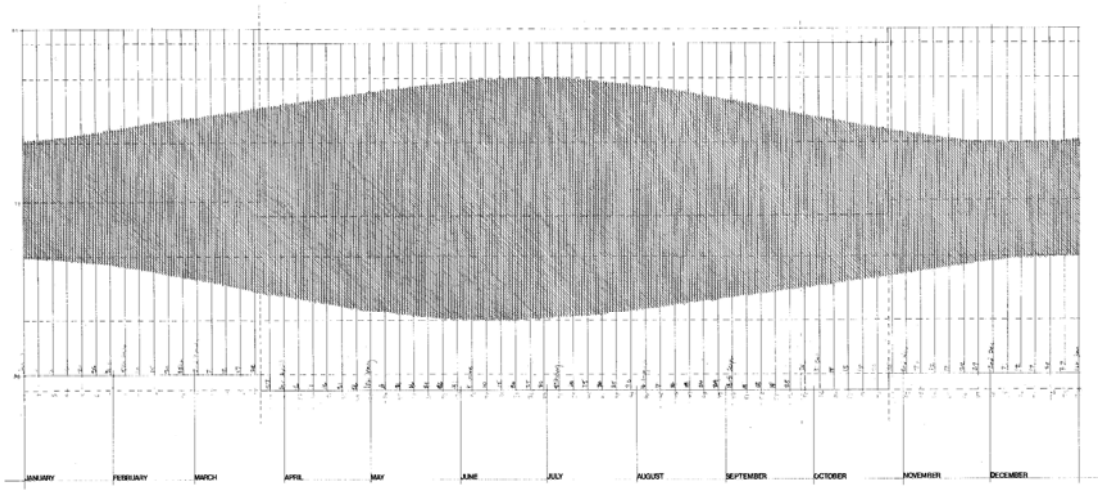

Figure 24: Initial drawing of the year in terms of the length of daylight of each day.
January is to the left, December to the right.

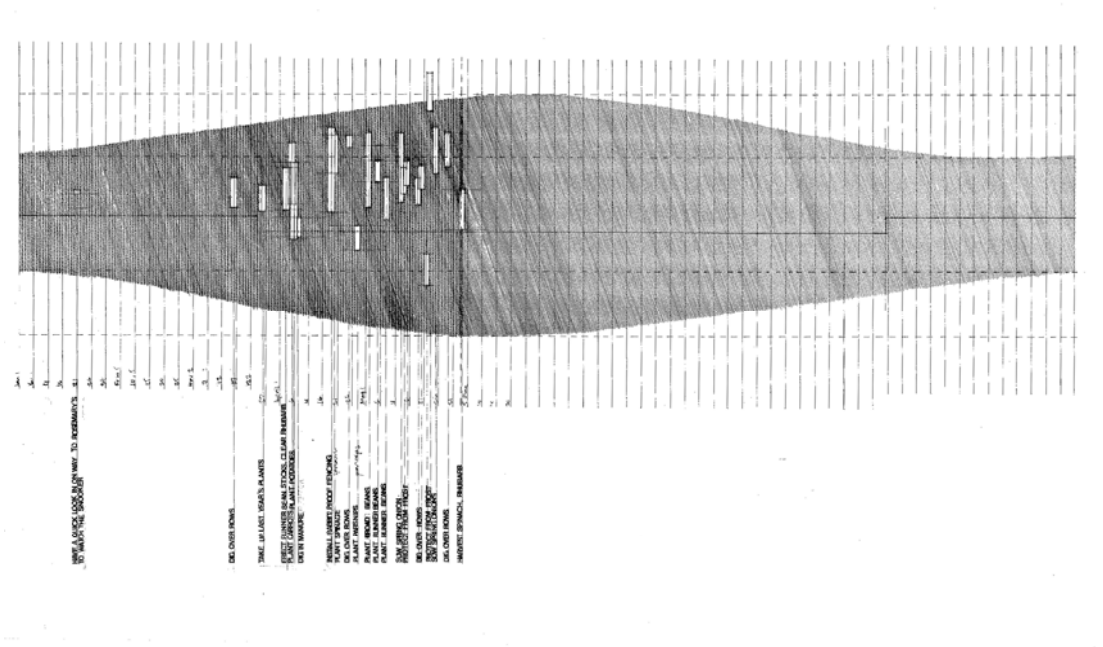

Figure 25: Mapping of Tony's work on the allotment so far during the year up to the day of my visit.

3.1.2.2 The calendar

My idea for the project came from these analytical drawings and is effectively a transposition of them, or, rather, of the making of them, onto the site at an inhabitable scale.[174] The proposal consists partly of the adaption of this notation to the site and partly of the mechanisms that are to carry out the notation process, comprising a minimal pergola at the back of the house opposite the kitchen window, spanning between the steps and the gate of the allotment (Figure 26-Figure 39). The pergola holds a marker (Figure 31, Figure 35) that moves back and forth each day indicating the present moment on the calendar while also inscribing the notation of the calendar into the ground (it is a marker both in the sense that its position marks a place and also in that it makes marks). I adapted the proportion of the notation system, which I had previously developed abstractly, to this new location (Figure 26, Figure 27) so that it forms the path to the allotment and would be walked through on arriving and leaving (one would walk forwards in the year on arriving and backwards through it when leaving).

There are two types of physical marks made on the calendar. Firstly, a line is scored into the ground each day, the length of which is proportional to the length of daylight that day, as per the earlier notation drawings (Figure 26, Figure 33). The marker moves at constant pace from one side of the path to the other over the course of the day, moving constantly towards the house and resetting at midnight in one movement. A scoring device lowers at dawn and is pressed into the ground, scoring a line in the grass as the marker moves, and is raised again at dusk, stopping the line being marked. The marker continues to move steadily before and after this, but without scoring the line, and so is moving constantly throughout day and night.[175] These scored marks would be faint

[174] In terms of the above account of the design process, I did not make the analysis drawings in the way I did in order to work out the proposal but rather I came up with the idea for the proposal by reinterpreting the analysis drawings as something propositional (seeing more in them than I had intended).

[175] Dawn and dusk would be measured locally on site in terms of a threshold of light level through light meters attached to suitable points on the house rather than calculated in advance. The marks are therefore indexes of what actually happens rather than an illustration of what is predicted to happen. The movement of the mechanism is however a form of clock time rather than solar time and by juxtaposing these, the calendar effectively has each measure the other.

but over the years they would reinforce each other with each year's marks being made directly over the top of those of previous years (give or take astronomical variations and the tolerances of the mechanism). The result of this mark making is to create a notation of the year in terms of daylight that is encountered at the entrance to the allotment. This notation forms the basis of the calendar, locating the other marks that are made.

The second type of mark that is made is in response to the activity on the allotment, recorded by attaching movement sensors to all the tools which Tony uses. When there is activity on the allotment, say when Tony is digging over a bed, the movement of the spade would be recorded and this would activate a second device on the marker. This would be similar to a dibber that one might use for planting seeds (though broader in one direction) and would move up and down into and out of the ground. It would be wider than the scoring device and would make a more immediately noticeable mark. The dibber would move up and down constantly while movement was recorded on the allotment while always moving along with the marker. For instance if there was activity for one hour, the device would operate for all that time during which it would travel 50mm and so make a mark of that length.[176]

As Tony works in the allotment, the marker makes these marks simultaneously. There is therefore an immediate sense of connection between the marking and Tony's activity—it starts and stops digging as he starts and stops—and so the indexical relationship is easily comprehensible. Whereas the first set of marks would reinforce each other every year and so become gradually stronger, the second set, indexing the activity on the allotment, would vary from year to year. Marks

[176] As a the marker would be moved along the calendar by a rack and pinion mechanism, while it would seem to move smoothly it would actually move in a series of small discrete steps. I am not sure of the dimension of these steps as I haven't designed the mechanism to this level of completion but I propose making them narrower than the width of the dibber. This would mean that considering the movement of the dibber as a being series of discrete steps, these different positions would overlap and so the dibber's mark making would appear continuous. The sampling rate of the sensors would be coordinated with the movements of the rack and pinion so that changes in location of tools on the allotment between the present moment and that when the dibber was in its previous position would result in the dibber starting (or continuing) to make marks while no change in their position would cause the dibber to stop (or to continue not) making marks.

would grow over or be trodden down with time (there would always be at least a year, and multiples thereof, between any two adjacent marks) and so the marks made by this year's activity could be differentiated from those of previous years.[177] Perhaps there would be a pattern to these marks—say that Tony worked there at similar times each day or that particular times of the year were especially busy—which would manifest itself in rhythms of the marks that were made or perhaps no pattern would be discernible.

As well as being a marker in the literal sense of inscribing the calendar physically into the ground, the marking device is also a marker in the sense that it indicates the present point on the calendar through its position. Each day the marker moves steadily across the width of the calendar (towards the house) and resets to the other side at midnight one notch (i.e. one day) nearer to the gate.[178] Over the course of the year the marker would therefore move very gradually from right to left as seen through the kitchen window. At New Year the marker would, having reached the gate, reset at midnight back to the stair end and begin again.[179] Walking to and from the allotment, and viewed from the kitchen window, the marker would be encountered very slightly nearer to the gate each day while it would be noticeably nearer to the house when leaving the allotment compared to when arriving, having moved across the path in that time. In this way, the marker reminds us of the

---

[177] The calendar's continued ability to make distinguishable marks relies on the recovery of the ground which it has already marked, without which future marks may not be discernible. This may, in practice require the marks to be tended depending on how well the grass of the lawn re-colonises them during the year. The marks of the drawings similarly have a tendency to clot so that no more marks can be made.

[178] The mechanism would reset at 12 midnight rather than during the middle of the duration of night time. This would mean that it would be more likely to be observable and marks the end to the day, which I take as being more significant than the middle of the night. 12 midnight is however arbitrary as it is dependent on standard time zones rather than the actual astronomical conditions at a location. This is partly revealed by the mechanism being set out according to GMT and not being adjusted to summer daylight saving with the result that, say, if one visited the allotment at 10am every day throughout the year, the marks recorded during the summer would shift by an hour compared to those in the winter with respect to the lines which record the length of daylight.

[179] To accommodate leap years there would therefore be a 366th line which would only be scored and marked every fourth year

passing of time and locates us at the present point within the calendar and within the context of our previous activity on the allotment as recorded in the older marks. This everyday activity and our present moment within it are situated by the calendar in a cosmological context through the notation of the differing lengths of days in the year.

One of the things which is notable about this project, and also those that follow, is that they, for the most part, do not change existing features of the situation in which they are proposed but instead add additional layers to them. This is partly a response to these situations already being enjoyable and rich. The allotment site doesn't need to be improved or changed—in terms of my previous discussion, it is explicit here that there is no "problem" to be "solved". That I am trying to add to this situation in any case is an example of there being no stopping rule—that it is always possible to think in terms of new possibilities. In adding to the situation I have tried not to take away from it. The only physical elements which are added are the minimal pergola and the marking device which it holds. These connect physically with the ground only at the pergola's four footings and in the marks made into the grass to form the calendar. This changes the character of the space between the steps and the gate giving it a sense of interiority, emphasising the moment of entering and leaving the allotment and framing a space within which to observe the calendar (Figure 34, Figure 38). However, while there is a sense in which my design adds to rather than reconfigures its situation, in another sense it completely changes the nature of our experience of this context. The marks made by the calendar bring our attention to the passing of time and to our personal history of passing time in this place. In this way, by refocusing our attention, the calendar transforms how we experience the allotment as a whole, not just how we experience the space of the calendar itself.

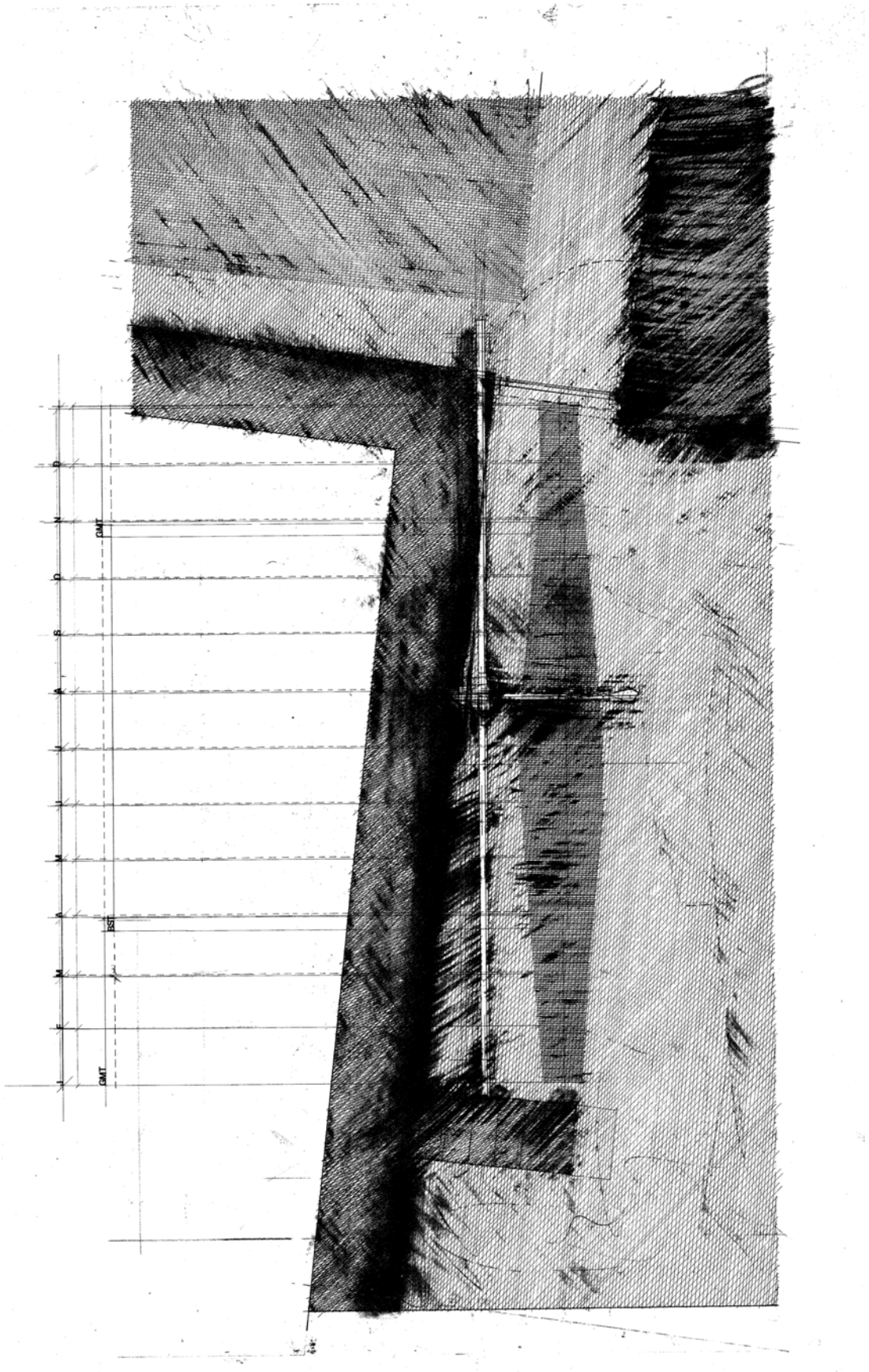

Figure 26: Allotment Calendar, first iteration, plan view.
Rosemanry's house to the top, allotment to the right.

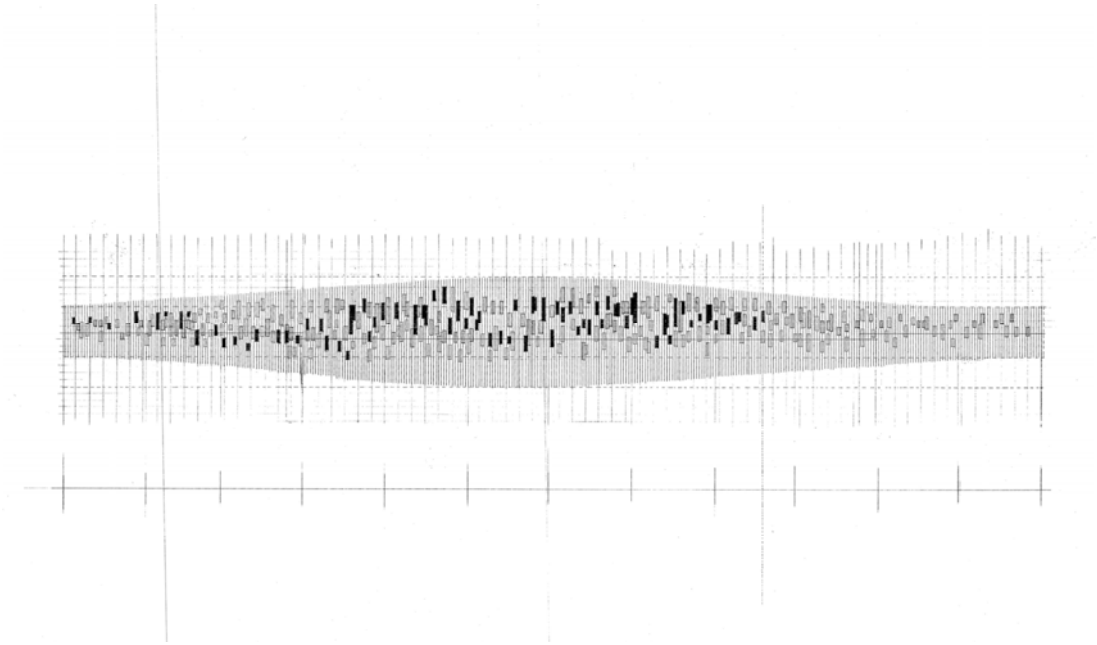

Figure 27: Drawing revising proportions of previous notations of the year to suit proportions of site.

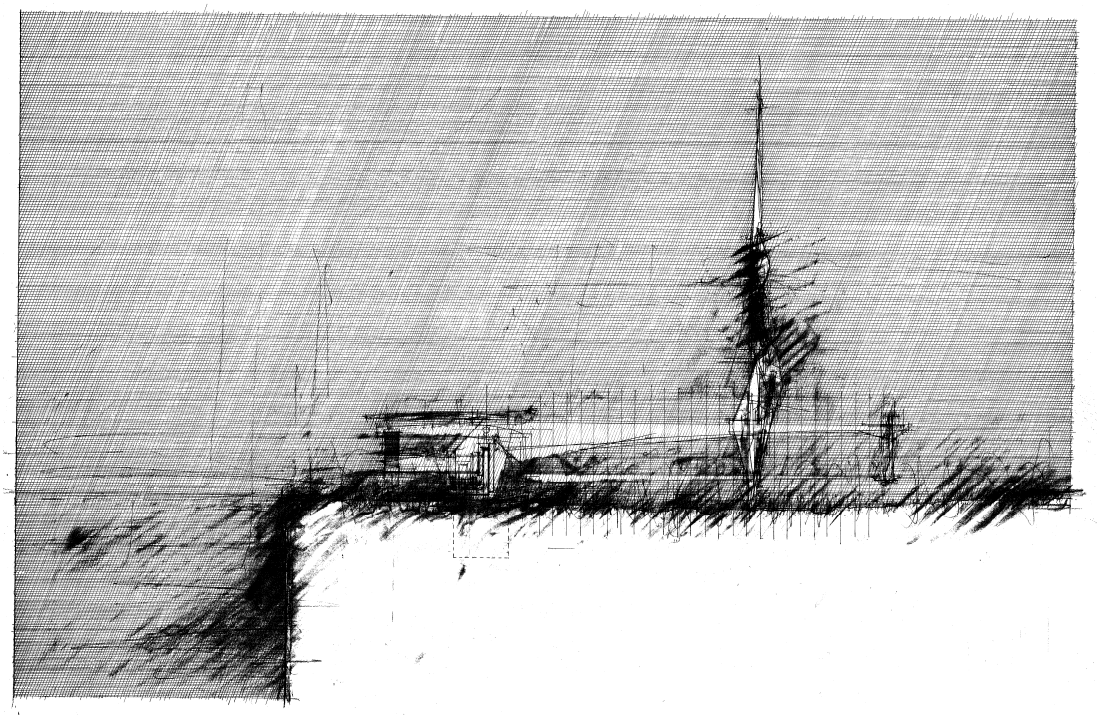

Figure 28: Calendar mechanism, iteration 1.
Rosemary's house is to the left. In this version one would either step over or walk around the calendar mechanism.[180]

[180] Similarly to the Contingency project (section 1.3 above), these drawings are drawn by hand using Rotring pens and pencil on tracing paper. The pencil marks, and the smudging of them using a rubber, are more prominent in this set, reflecting the concern of the project with mark making. In order to exaggerate this I have used an older xerox-photocopier

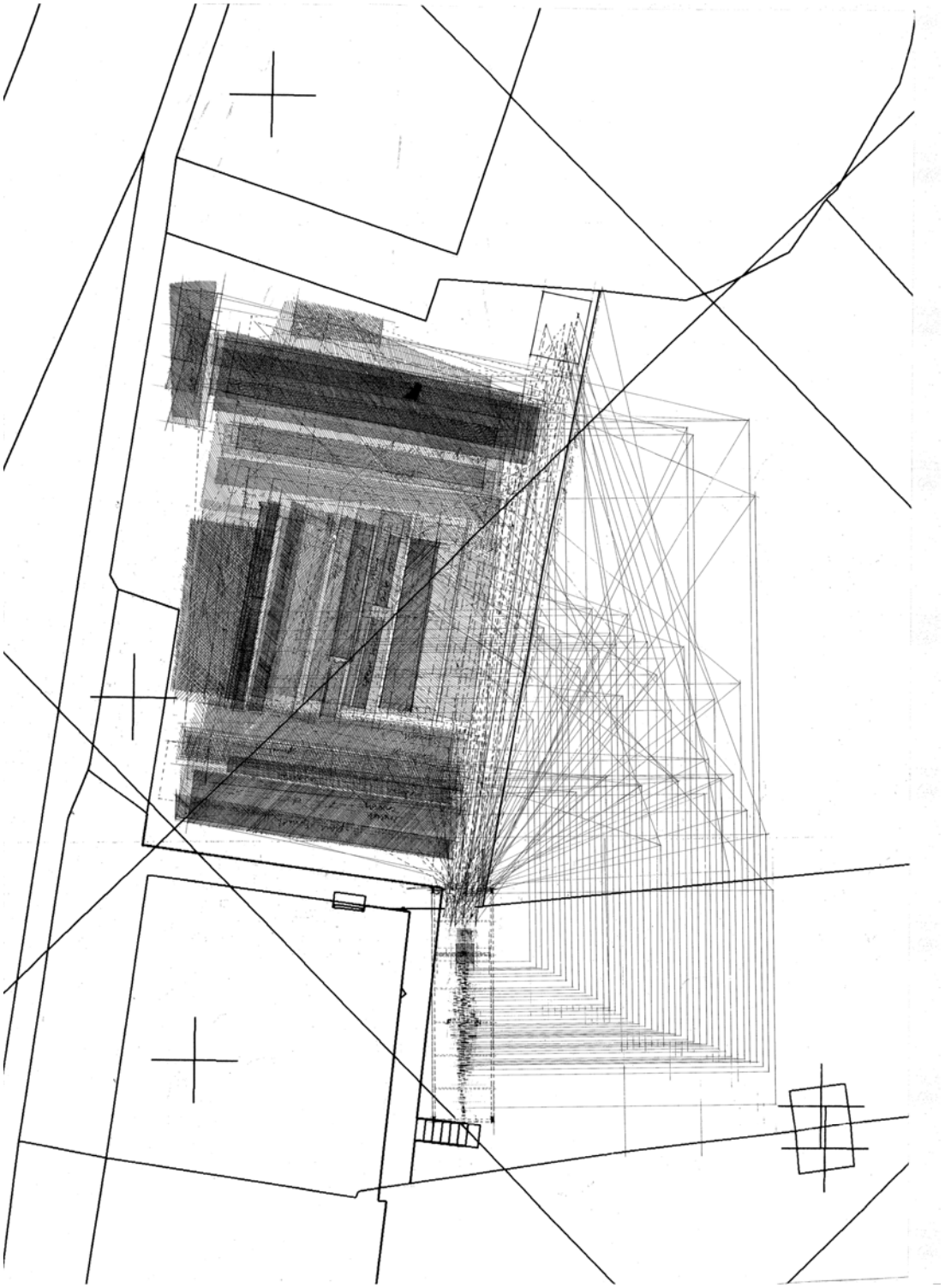

Figure 29: Site plan.
This drawing indicates connections between marks made by the calendar and the location of the activities on the allotment (digging, planting, picking etc.) which they index.

with most of these drawings, as this tends to pick up more of the pencil work as well as accidental marks on the paper, rather than the cleaner copies made by more modern machines.

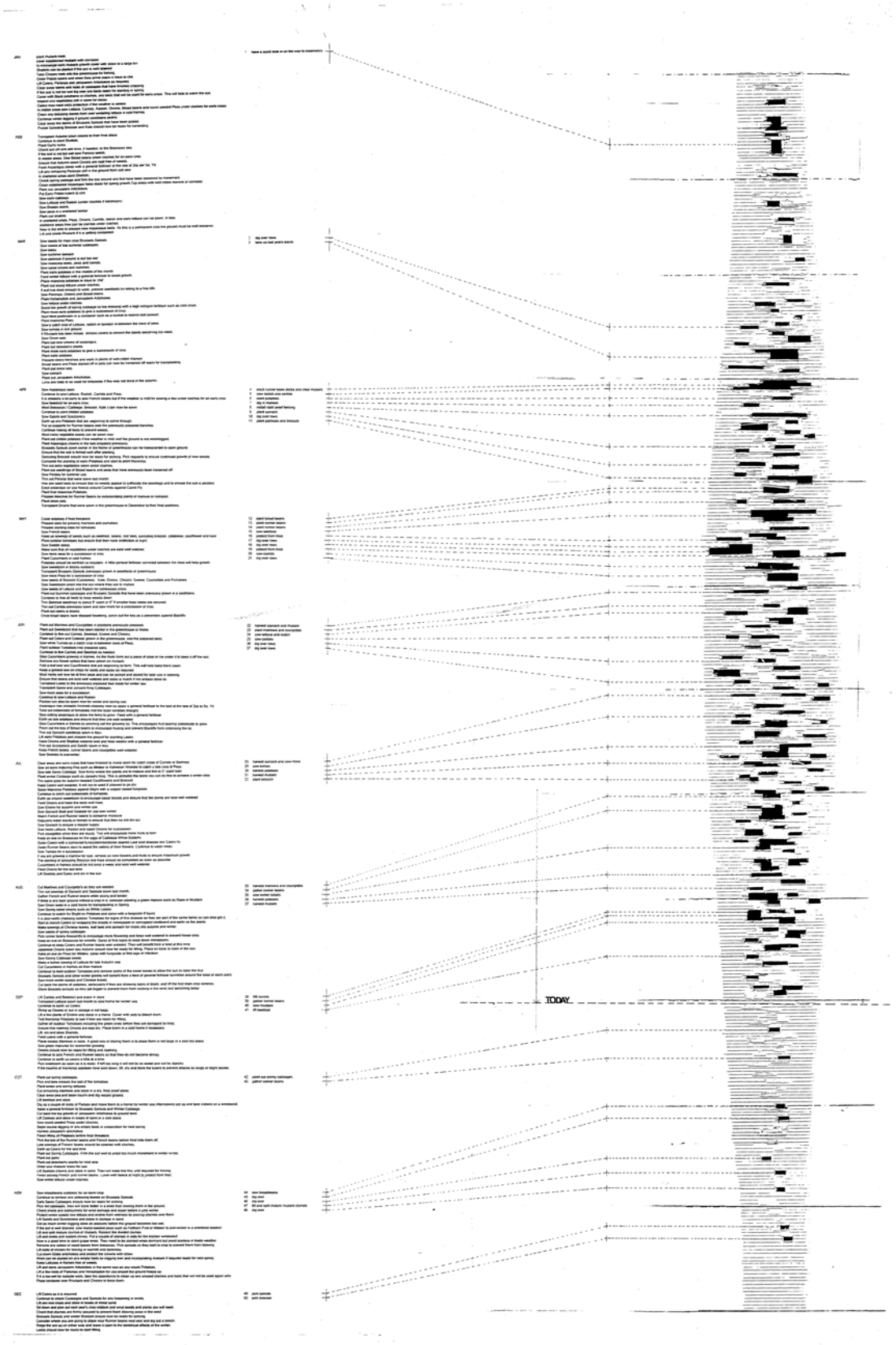

Figure 30: Mapping of activity of allotment over the year against the marks on the calendar.
From left to right: list of possible allotment tasks for each month; those undertaken by Tony; their location on the calendar along with marks from the equivalent activities in previous years.

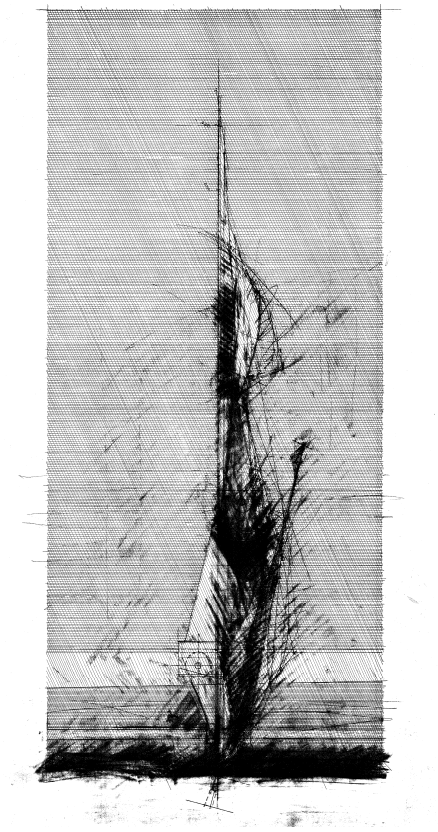

Figure 31: Study for marker, iteration 1.

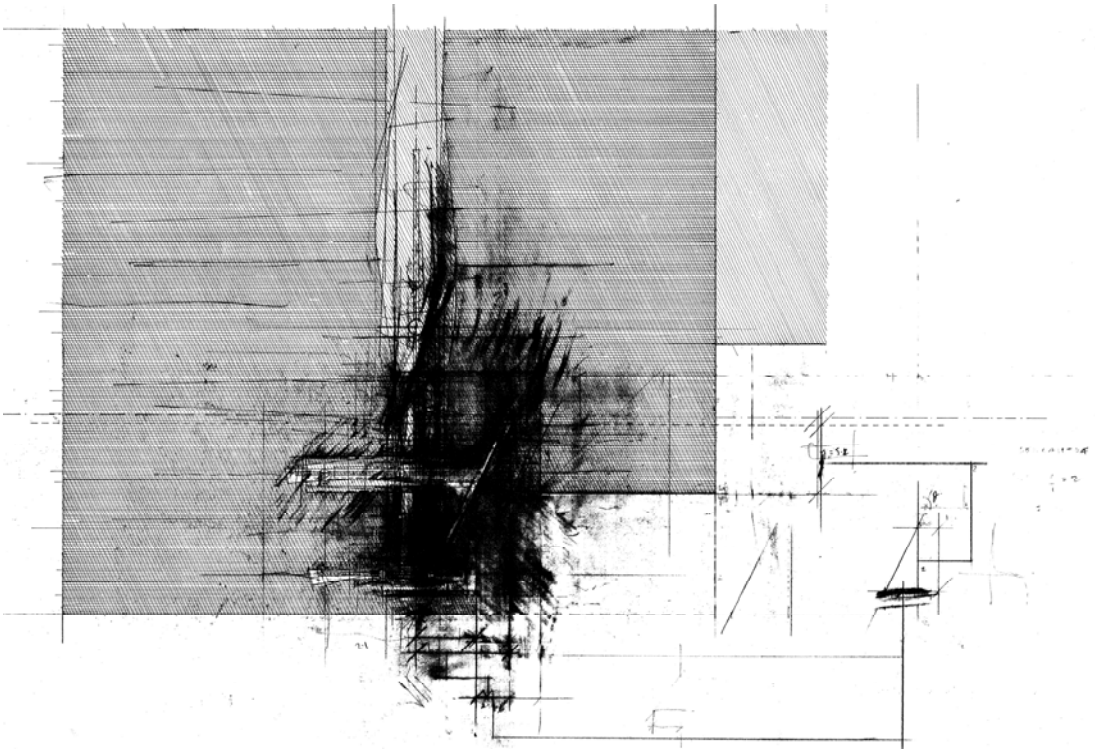

Figure 32: Initial study for marker.
This is my first drawing for the marking device where, in an early iteration, I was considering positioning the calendar in the sunken passage at the side of the house. The smudging of the drawing came from continually erasing and redrawing due to struggling with a particular aspect of the design (how to negotiate an existing step which I did not want to remove). The smudging which was here accidental is something I enjoyed for its sympathy with the site, leading me to use it more deliberately in the other drawings.

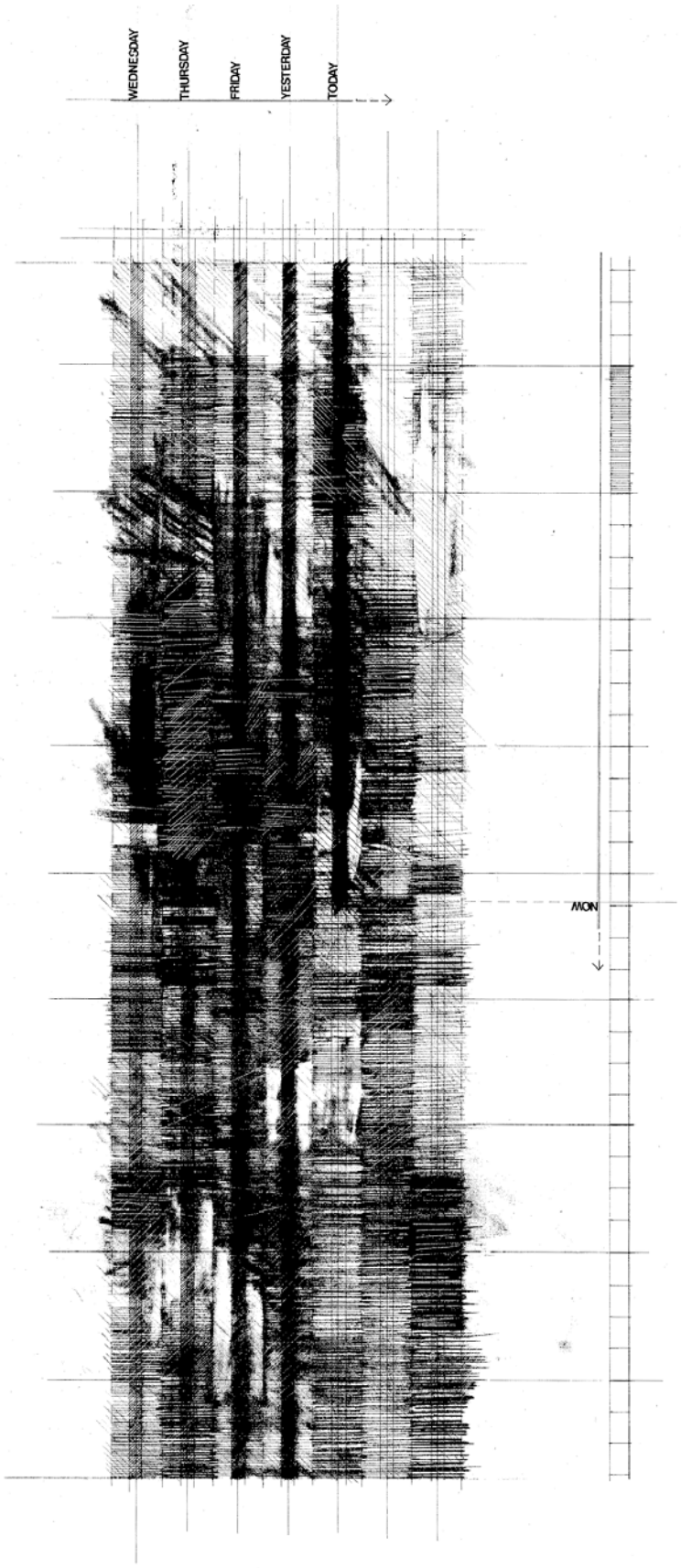

Figure 33: Study of accumulation of marks over a number of years on the calendar.

Figure 34: Collage study for pergola, iteration 2.
Note the framing of the gate and of Rosemary's house by the pergola.

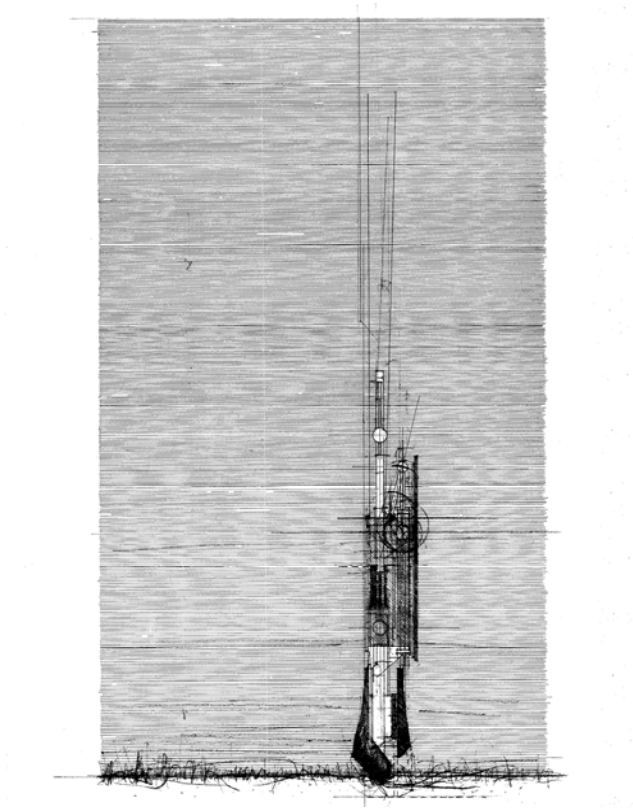

Figure 35: Revised study for marker, iteration 2.

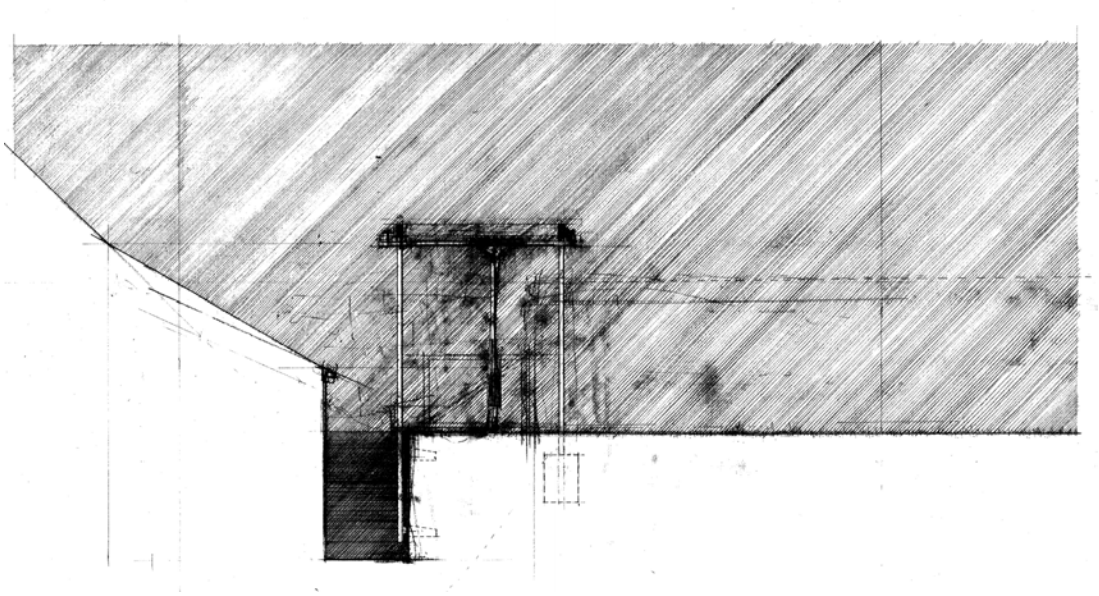

Figure 36: Section through calendar, iteration 2.
Looking towards allotment with Rosemary's house to the left, her garden to the right.

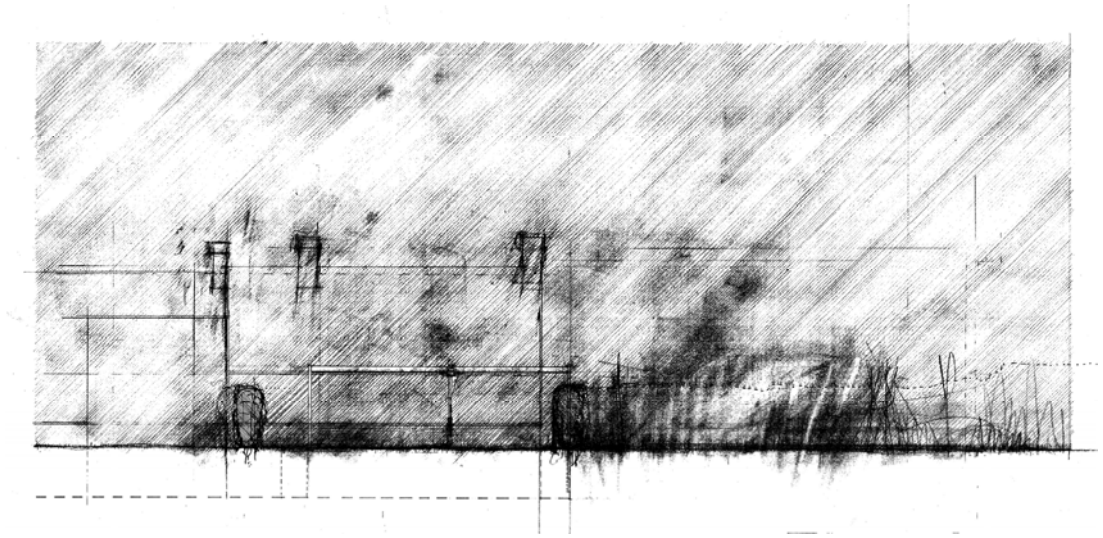

Figure 37: Elevation looking from Rosemary's garden towards the calendar and her house.

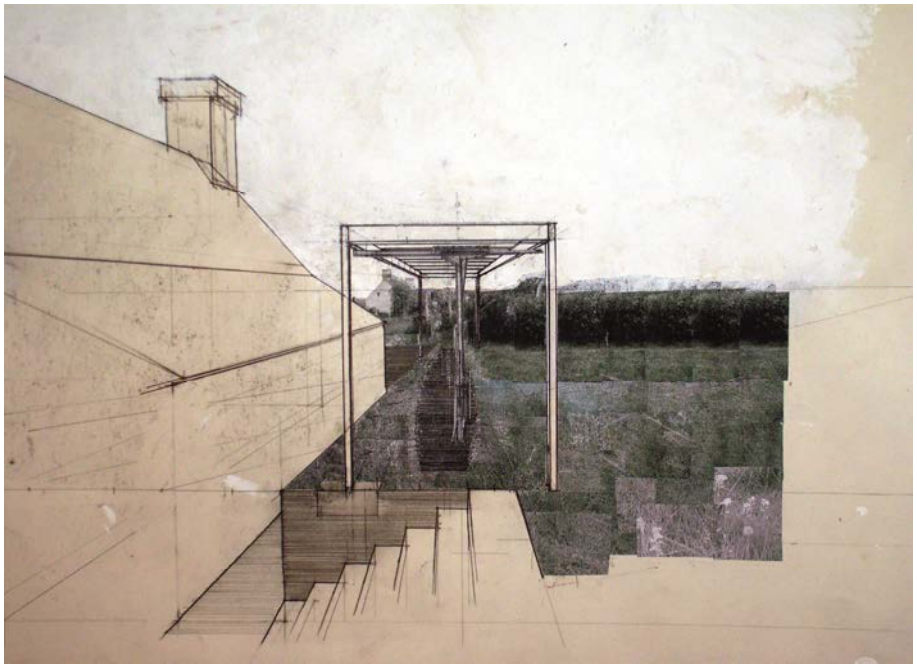

Figure 38: Sectional perspective from top of steps looking towards calendar and allotment. Rosemary's house is to the left.

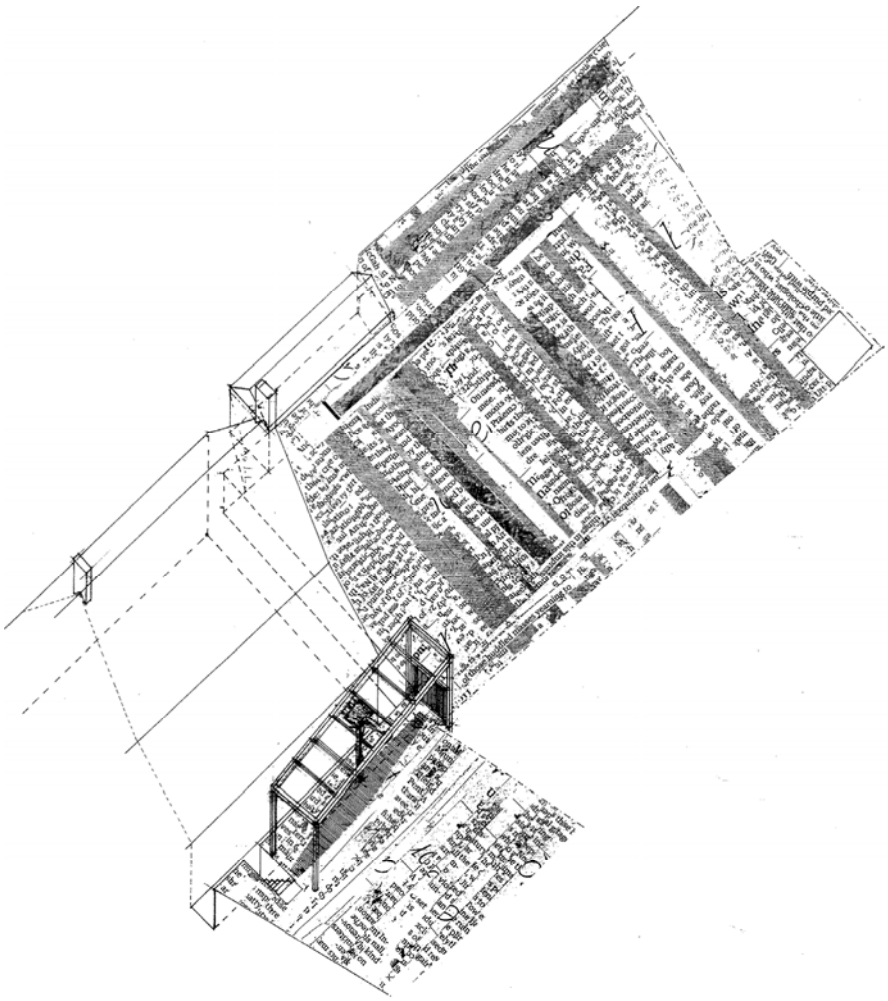

Figure 39: Axonometric of calendar, Rosemary's house and allotment.

3.1.2.3 Repetition and variation

One main theme of the project is a tension between repetitive patterns and variation from them. Part of the enjoyment of an allotment is its repetition—the regular rhythm of visiting to tend it, the repetitive nature of the tasks undertaken there such as digging over the ground and the similarity of one year's work to the next. This is also reflected in the context of time with the daily rhythm of sunrise and sunset, the variations of these over the seasons and the repetition of these seasons each year. By recording these patterns, the calendar highlights this repetitive rhythm and the variations from it. This quality is also reflected in the nature of the marks which the calendar makes, which repeat each other but with slight differences given changes in the length of daylight and in the patterns of activity at different times of the year and from one year to the next. This combination of repetition and variation is similarly reflected in the parallel lines of hatching in the drawings, continued from the Contingency project, which repeat the same action with minor differences in spacing and length each time. In both the calendar and the drawings, the repetitious nature of the action highlights variations from it and vice versa.

3.1.2.4 Constructing an index

The marks made by the calendar and those of the notation drawings can be interpreted as meaningful not because of any properties they have in themselves but, rather, because of their indexical connection to the activity of the allotment. However, they are not totally distinct from the sort of coded symbolism with which an index can be contrasted.[181] Encountering the marks for the first time, whether in the drawings or on a visit to the allotment, they form a static pattern which needs to be explained. Though the marks follow from their inputs, that and how they do this is not immediately obvious. In order to understand the marks as an index without explanation they need to be observed over time—the causal connection is not enough in itself. That is, something is understood to be an index where an observer constructs the understanding of a causal connection in order to explain their experience of it. It is the viability of such a construction rather than

[181] As Peirce (1901) notes, "it would be difficult, if not impossible, to instance an absolutely pure index, or to find any sign absolutely devoid of the indexical quality" (para. 3).

whatever process actually occurs that is relevant and something could communicate as an index even if its causal connection is only apparent rather than actually the case. In the case of the calendar, the causal connection is relatively easily discernible as the mark making starts and stops with Tony's digging or with the rising and setting of the sun. That is, the form of the mechanism and the process which it undertakes are such that they can viably be explained as an index.

The indexical marks on the calendar correspond to the activity recorded from the allotment. While the calendar is not concerned with constructing an understanding but only with processing and ordering data or information, the linearity of this indexing has a similar form to epistemological realism. Its creation of marks which correspond to events is comparable to the idea that we receive information from the world around us and create and manipulate representations of it in our mind. However rather than supporting such a model of cognition, it reveals its limitations—if we think of epistemology in terms of correspondence, there can be no more understanding than there is in the translations made by the calendar. The marks are not meaningful in themselves. Rather, it is through our interaction with the calendar's mark making where we create understanding—we construct the order in the patterns the calendar makes by finding viable ways of interpreting the marks. Likewise, when we communicate in a similar way, say through a code or through the agreed meaning of a word, we do not transfer understanding but only information (differences) and it is instead the listener who creates understanding for themselves.

I find that the indexation in this project attempts to be too complete and, by appearing to record and contextualise everything, gives the impression of realism. It is of course not comprehensive but partial, recording only daylight and the movements of a few tools. It depends on this abstraction in order to be comprehensible and like any abstraction it cannot hope to capture the richness of any actual situation. But, rather like the way particular turns of phrase such as "really" lend the implicit impression of objectivity to our statements, so too the form of the calendar suggests that it is comprehensive because it is always recording day and night and contextualises

this within the year as a whole.[182] While one might develop the project by attempting to make the indexation more and more accurate or complete, and so communicate more and more information, such an approach would lead to it being of less and less communicative value as its abstraction decreases.[183] The most significant aspect of the project is the establishment of the connection rather than its specific details—that I see the connection between myself and the marks made on the ground, and between this situation and the seasons, and so become more aware of my presence here and this place's presence in the world. The particular choice of what information the calendar records and orders is secondary to this—any information would do.

While the calendar is in this sense overly explicit, with marks corresponding to particular events, the significance of these marks remains ambiguous. My original intention in the project was that in representing Tony's activity back to him it would encourage him to make his choices more actively. By visualising his activity within its context I thought it would prompt him to choose with more experimentation and variety rather than out of habit. While this may well be the case, the project might equally encourage a conservative or traditional routine to be followed—to do the same thing day after day and year after year. The significance of the marks is not a property of them and the meaning of the project for Tony is for him to decide; he will choose whether it will be a prompt for variation or for tradition or indeed neither.

3.1.3 Toast Rack/ Staircase Clock

The two projects that I present in this section are not as elaborately developed as the Allotment Calendar. Both are responses to questions raised by the Allotment project and are continuations of my discussions of it. Each project is set in the context of my own daily life, in the

---

[182] Von Foerster set up the equivalent of a swear box with his students to which anyone using terms such as "reality", "really", "truth" or "objectivity" would have to contribute a couple of dollars (von Foerster & Poerksen, 2002, p. 40).

[183] Taking this to its extreme would lead to the map making described by Borges (1946/1998) where maps become useless because of their accuracy.

house in Hackney, East London, which I lived in at the time, renting a room in the attic.[184] Similarly to the Allotment Calendar, both are devices that index a typical everyday situation in a way that makes patterns visible which would otherwise remain unnoticed. While the projects form indexes, these do not order the information they record as comprehensively as the Allotment Calendar. Instead, in these projects I have concentrated on establishing the sense of connection with the world that I have taken to be the strength of the Allotment project, without the appearance of objectivity which that project implied.

3.1.3.1 Toast Rack

The first of these two projects is sited on the kitchen table, a location so characteristically everyday that it is even a term for the everyday itself. Our kitchen table was the social centre of the house as well as performing its more prosaic role as the place to prepare food (Figure 40). In this project I proposed adapting our toast rack so that it would record an aspect of the temporal character of the table. I proposed adding pressure sensors to each bay of the toast rack in order to give it the capacity to sense when toast is placed on to it (Figure 41-Figure 45). The sensing of a load triggers the toast rack to start tapping on the table at occasional intervals, say a couple of minutes apart, with the six small pneumatic hammers which form sets of outriggers along its sides. This tapping would become very gradually more frequent and more vigorous until the toast was removed from the rack, unloading the sensor. If the toast was left there for, say, a whole day, one would return to the toast rack banging vigorously on the table. Initially, then, the tapping of the toast rack would act as a prompt to eat the toast before it went cold and then become a reminder to clear away the cold toast if it was abandoned there. This might form one part of a constellation of similar everyday objects all agitating for themselves to be used and interacted with.

[184] These are two of a number of small projects I worked on during this period (2007-2008) in order to explore different directions in which to respond to the Allotment Calendar, most of which comprised only a few sketches. I present only these two because it is these that are relevant to the path that I did take.

In this way the toast rack acts out a simplified version of a provocative form of responsiveness where, rather than adapting to how it is used, the toast rack provokes us to use it.[185] This may lead to a variety of responses. As well as being a reminder to eat or clear away the toast, we might allow the toast rack to continue its mark making because we enjoy the rhythmic sound of its tapping or the marks it makes on the table top or even to assert our individuality against the reminder by the machine. Like the Allotment Calendar, the significance of the toast rack will be something that is to be decided by how we respond to it.

The main feature of the project, though, is not this simple version of responsiveness but its concern, like the Allotment Calendar, with mark making. The hammering on the wooden table top would form a series of indentations of varying depths depending on how long the toast rack was left loaded in a particular position. These would accrue over time to cover the table, forming an index of the toast rack's use in terms of its positioning and the durations of it being loaded (Figure 42). Though this is comparable to the Allotment, the marks on the table would not make a comprehensible whole in the same way and could not, for the most part, be traced back to specific events, although patterns may emerge in terms of the position of the toast rack which might be self-reinforcing (creating its own grooved location or locations) or the opposite (spreading the wear evenly) depending on how we respond to it. The toast rack adds to the slow wearing and scratching of the table top from everyday use, making visible what are otherwise intangible events.

[185] There are many much richer and more sophisticated examples of such a strategy such as Pask's Musicolour, with its capacity to become bored and provoke the musicians it accompanied into improvisation (Pask, 1971; Pickering, 2010, pp. 313-21), and the use of similar algorithms in Price's Generator project (Frazer, 1995, pp. 40-41; Pickering, 2010, pp. 372-373; Price, 1984, pp. 92-97; Spiller, 2002, pp. 84-89; 2006, pp. 204-207; Steenson, 2010).

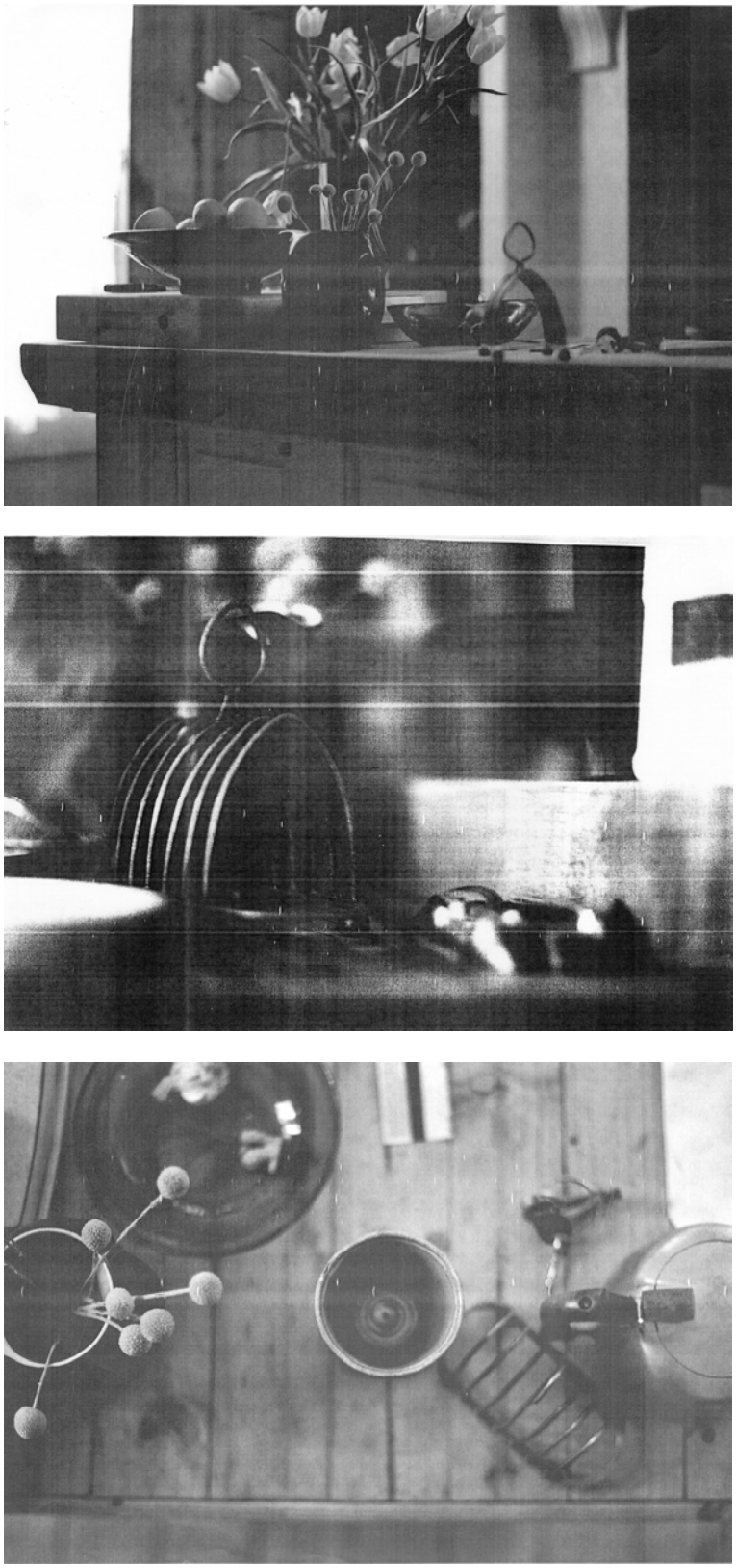

Figure 40: Toast rack, as existing, on kitchen table.

Figure 41: Toast rack, as proposed, plan view.
This drawing has been made at 1:1 scale, using a rubbing of the table top and photocopies of the toast rack.

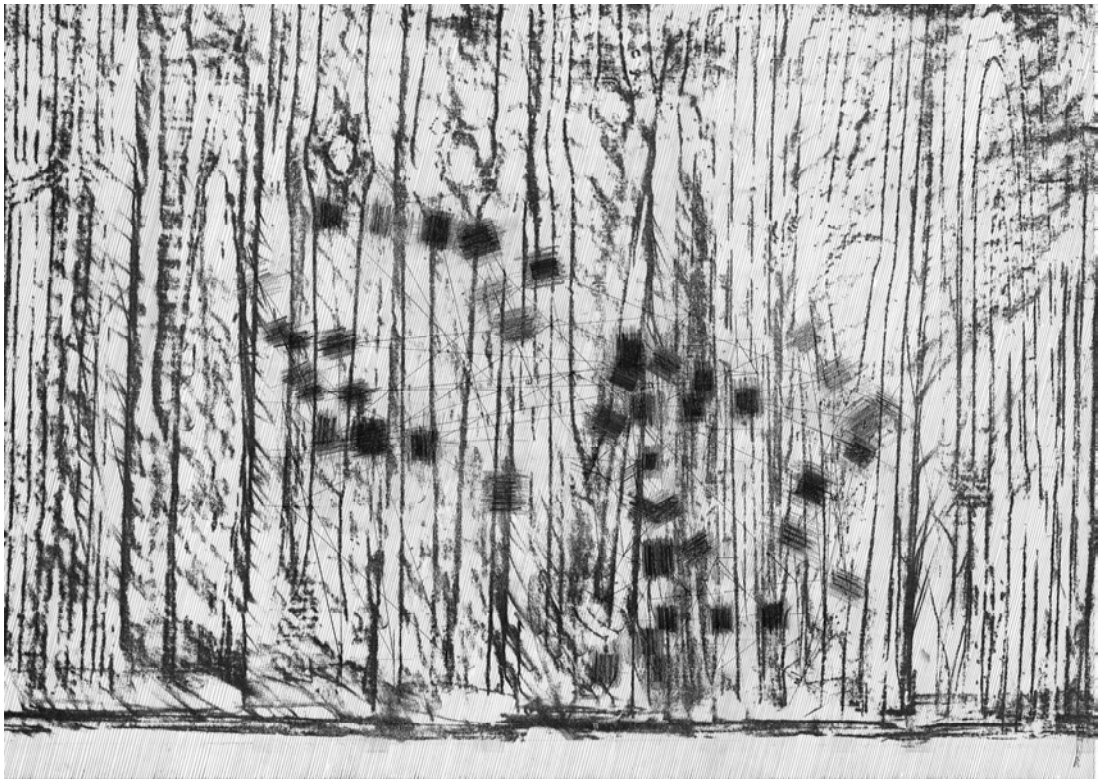

Figure 42: Study of possible indentations made by the toast rack shown over existing indentations of kitchen table.

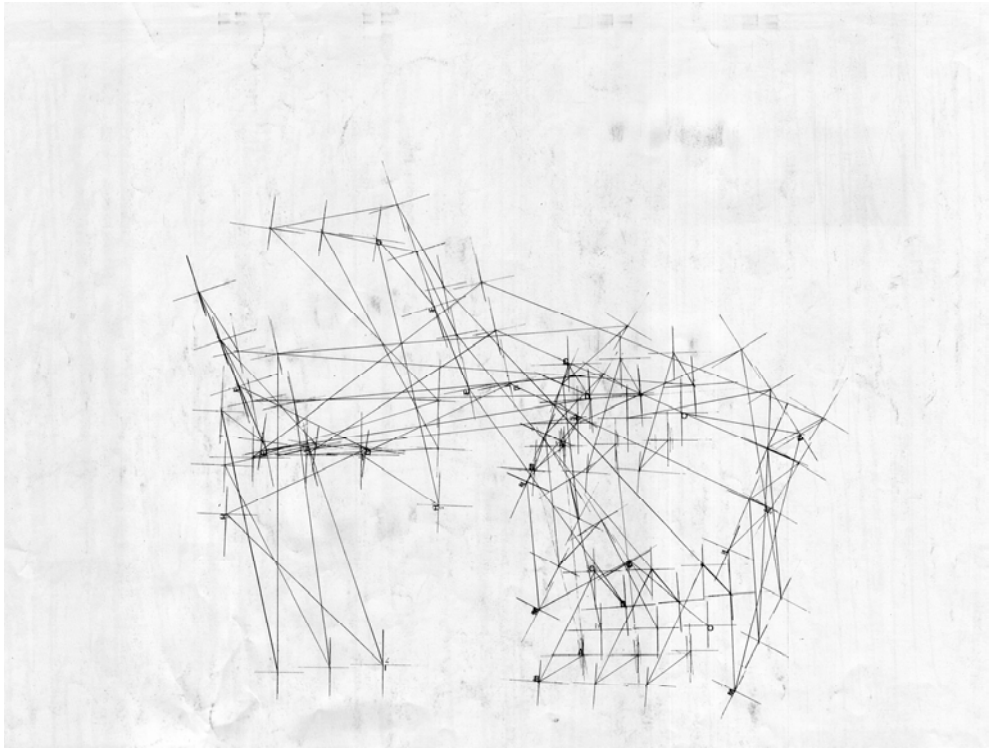

Figure 43: Diagram of some imagined movements of the toast rack.

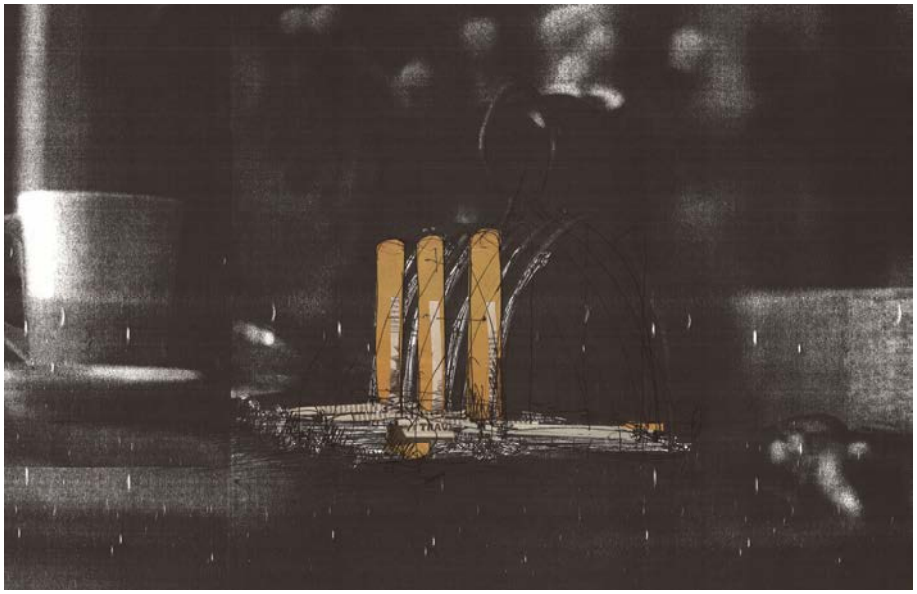

Figure 44: Collage study of toast rack as proposed, in context.

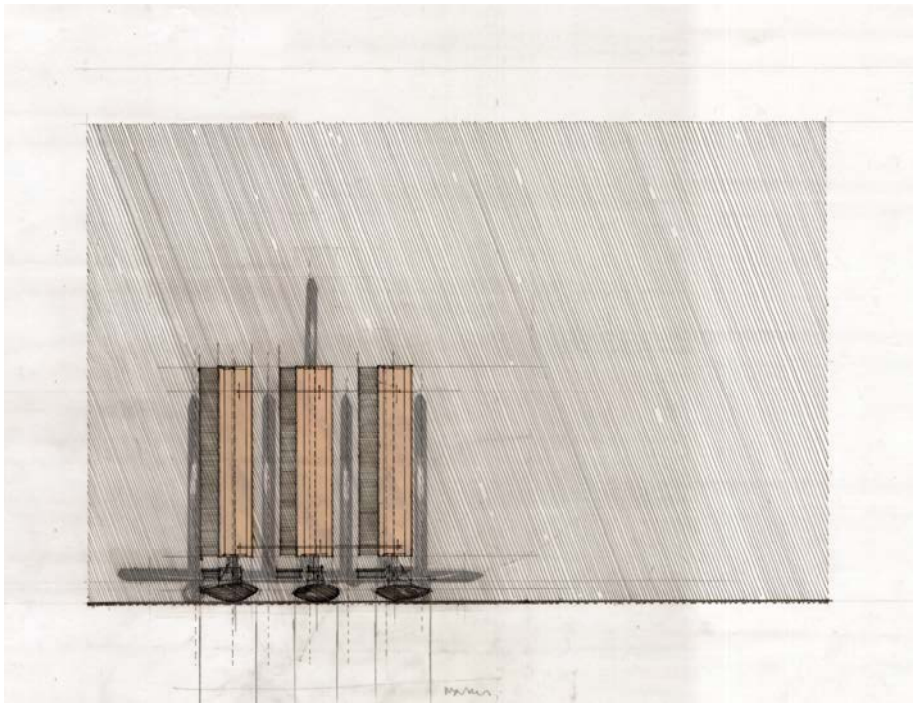

Figure 45: Toast rack as proposed, elevation.

3.1.3.2 Staircase Clock

Staircase Clock, the second of the two projects which follow on from the Allotment Calendar, is also set in the same house in Hackney. I developed this project very quickly in only a few sketches and it is more a thought experiment about the Allotment Calendar than a completed design. Similarly to the focus of the Toast Rack project at the kitchen table, this project is also located at a point in the house which is a fulcrum of everyday happenings—the staircase (Figure 46, Figure 47). The staircase of a house acts as a connection and also a separation between the rooms of different floors and as such is central to all the comings and goings of the house. My proposal treats the staircase as a way of indexing the house by recording the timings of its use, turning the staircase into a measuring device recording and articulating the rhythm of the house.

The proposal consists of a column in the centre of the stairwell which the (L-shaped) staircase moves around (Figure 48-Figure 51). A mechanism steadily climbs the column from bottom to top once a day passing a series of wooden blocks, taking 15 minutes to pass each one (there are 96 blocks in total, one for each 15 minute period in the day).[186] In the same way that the position and movement of the marker in the Allotment Calendar indicates our present place within and movement through the year, so too the height and movement of this mechanism indicates the present moment and movement through the day. Pressure sensors installed into the middle treads, where the stair changes direction, record instances of people ascending or descending the staircase.[187] Whenever the staircase is used, the mechanism pushes out the wooden blocks it is

---

[186] My reasons for specifying 15 minute time interval are twofold. Firstly, this number of divisions fitted well with the floor to ceiling height while giving an appropriate block dimension (that is, by allowing block dimensions which I judged work well in the proportions of the space as I sketched this out). Secondly, the time interval is small enough so that even if someone was at home all day then there would still be some blocks that would not be pushed out (whereas they probably all would be for an interval of an hour) while not so small that they would mostly remain in (as they would for an interval of a minute).

[187] The significance of placing the sensors on the middle treads is, firstly, that it would be sure to be trodden on even if one was going several steps at a time (as it is where the stair changes direction) and, secondly, that it would only be

adjacent to at that moment. The position of the blocks at the end of the day would therefore be a record of which 15 minute intervals the staircase was used in (although not the total uses of the staircase during those intervals) and so would reflect something of the pattern of activity and inactivity of the staircase, and so the house, during that day. At midnight the mechanism would reset itself, pushing all the wooden blocks back to their original position in what would be a ritual observing the passing of one day to the next. This would happen at midnight which was, perhaps strangely, our particular household's busiest time of day.[188]

Compared to the Allotment and Toast Rack projects, the Staircase Clock is indexical in a much more immediate and transitory way. Although the pattern of the blocks similarly notates a series of events within a time frame as with the Allotment Calendar, the pattern does not present itself as complete or even significant (the information is continually erased; there is no significance to one block being pushed out compared to another; the way the readings are made is conspicuously blunt). The pattern is made every day and reset rather than aggregating over time. That it is made every day relates to the daily pattern of a house as it is present in the staircase: the repetition of the days and the feeling that every day starts anew and has a beginning and an end (which typically involved descending and ascending the staircase). There is, though, still a slight sense in which the Staircase Clock, despite its daily resetting, would accumulate a pattern. Some blocks, corresponding to particular times, may be pushed out more often if the staircase was ascended or descended at some times more regularly than at others. These blocks would wear away more noticeably than the others creating a varied patina and perhaps eventually not returning fully to their original position and being left stranded halfway. The installation would therefore accrue a character over time so that it would reflect daily rhythms as well as indicate that day's events.

---

trodden on during more or less complete ascents or descents so that the device would not record inputs for very partial uses of the stair where one changed one's mind after only a few steps.

[188] As with the Allotment Calendar, by midnight I mean 12 midnight rather than the middle of the night for similar reasons.

The Staircase Clock marks time in the house but it does not interfere or regulate it. It is separate to the staircase and does not intervene in how one ascends or descends. It is not interactive or circular, there is no feedback; it is entirely mechanistic and predictable. Indeed it is a pattern noticeable across all these projects (including the Allotment and Toast Rack and those that follow below) that the proposals I have made add another layer to an existing place without substantially changing or regulating its existing features. The interventions sit above or alongside what they measure, and while they reflect on it, they leave it unchanged. Yet in another sense the Staircase Clock intervenes in the space of the staircase significantly, similarly to the Allotment Calendar. Not only would I be able to consult a record of what has happened that day, but also in using the stair I would observe (in the sense of constructing an understanding) that I am being observed (in the sense of being recorded). Indeed, it is not the mechanism and the moving blocks, the pressure sensor or even the staircase which is the measuring device but, rather, the mechanism *and* the sensor *and* the staircase *and* the house's inhabitants *and* its visitors together (compare Bateson, 1972/2000, pp. 465, 491). The most interesting aspect of the Staircase Clock is where one understands not that it is measuring us but that we are measuring it and its measuring of us.

Figure 46: View of staircase, as existing, from entrance hall.

Figure 47: View of staircase, as existing, from upper landing.

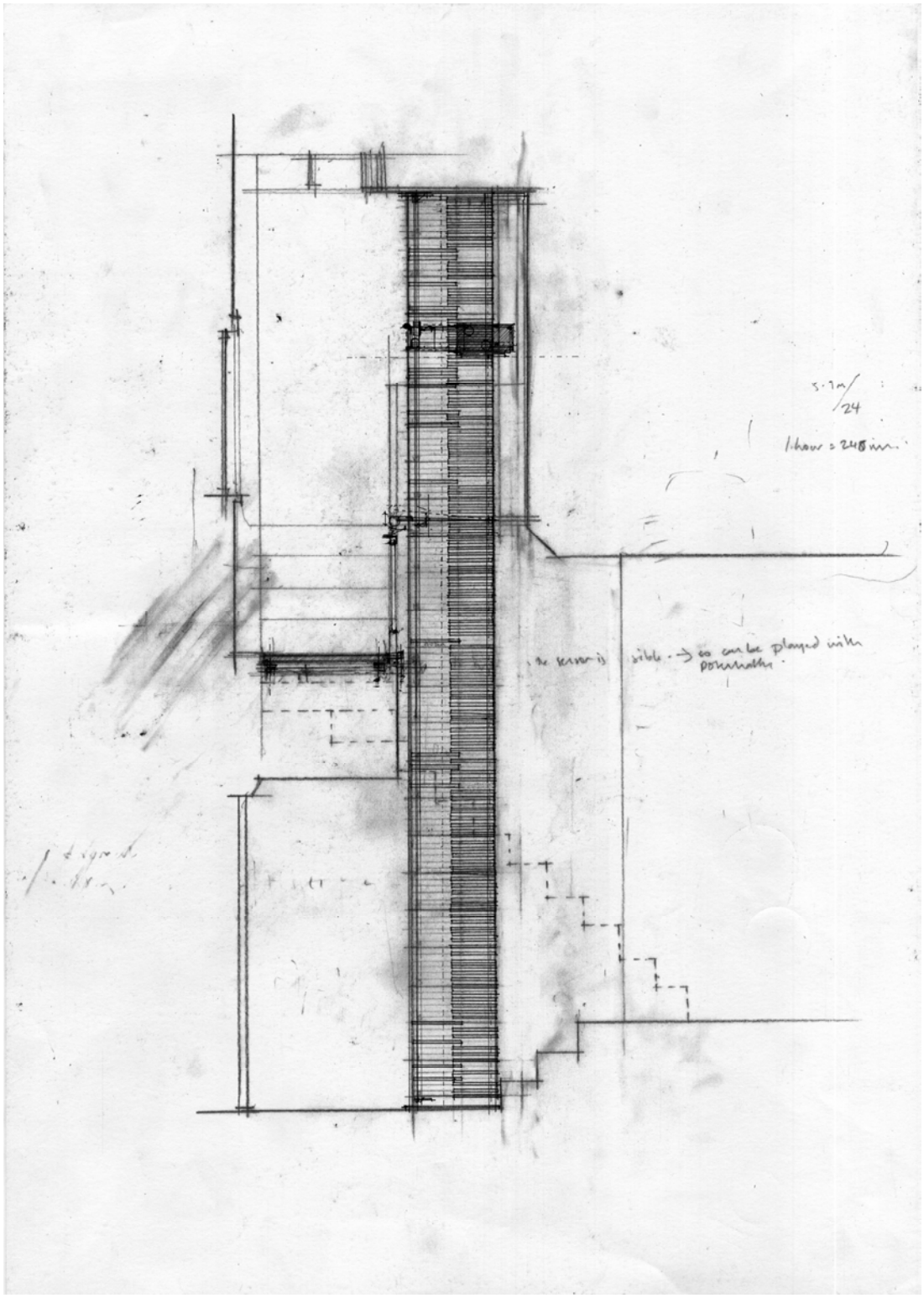

Figure 48: Staircase Clock, section.

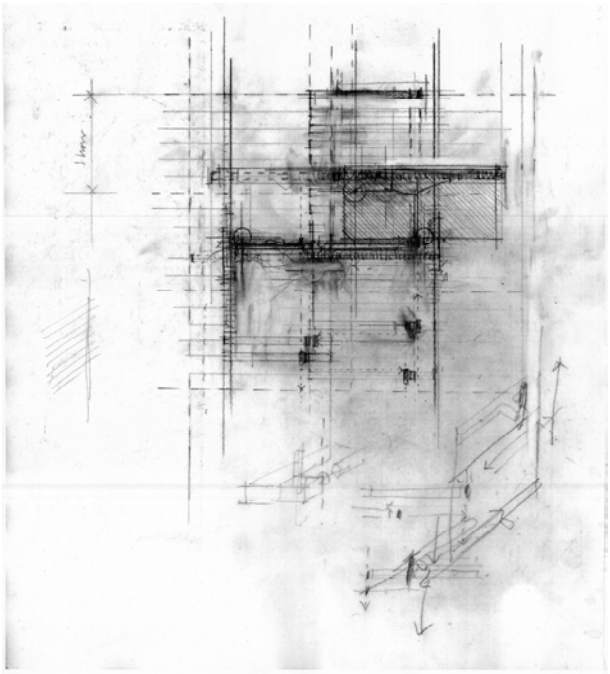

Figure 49: Sketch for the mechanism for moving the blocks out and back.

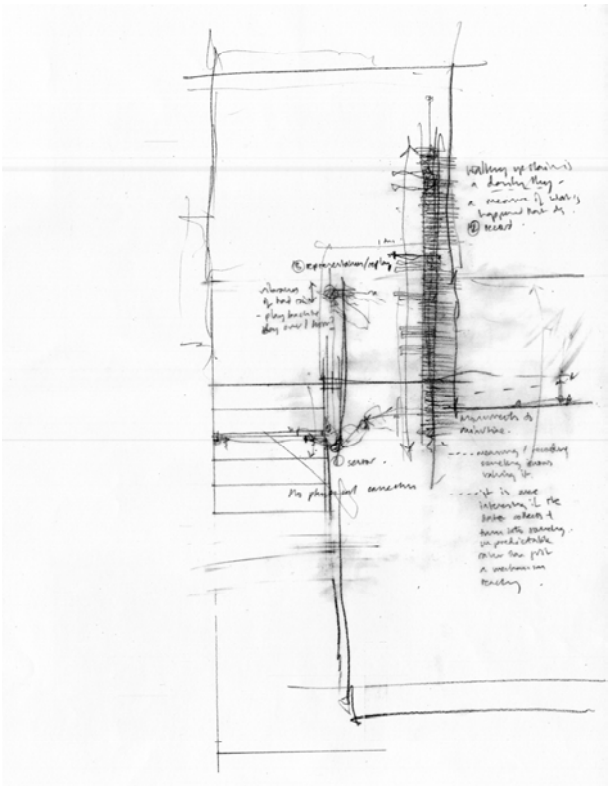

Figure 50: Initial sketch.

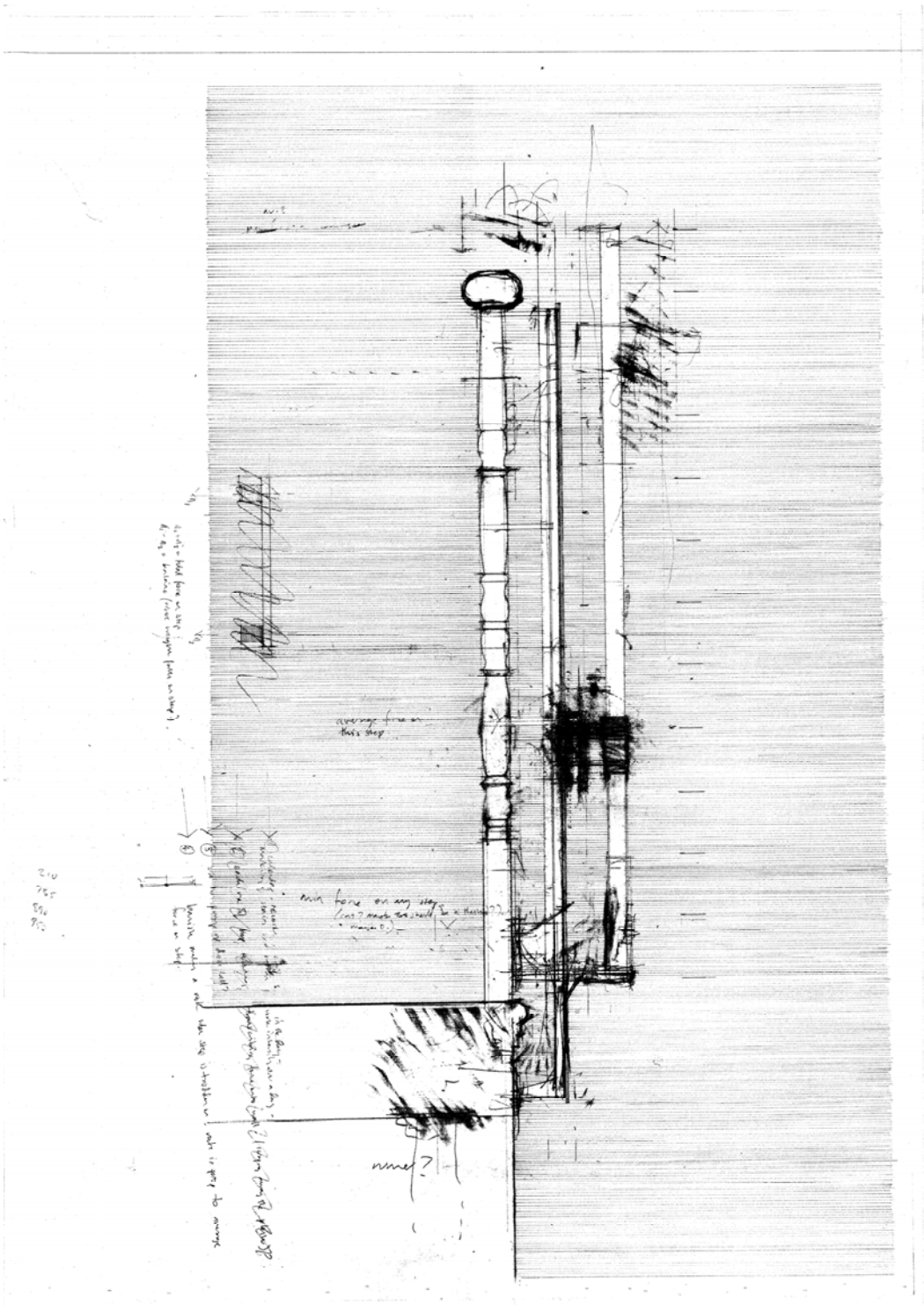

Figure 51: Sketch of stair rod with initial idea for measuring device.

3.1.3.3 Comment: Allotment Calendar, Toast Rack, Staircase Clock

The Allotment Calendar, Toast Rack and Staircase Clock projects have close similarities. Each is a measuring device designed for a specific everyday situation that records its surroundings in terms of the durations, timings and intervals or particular actions. Each uses these measurements to create an index of its inputs. The durability of the index is different in each project. The Allotment Calendar superimposes marks over those made in previous years which have faded away (by being trodden down or overgrown) allowing the new marks to be distinguishable and while the pattern of the marks is changing constantly it is always of a similar order embodying a long but limited period of its history. The marks made by the Toast Rack are permanent scars to the table top. These marks will not heal or fade out, as with the marks of the Allotment Calendar, but are additive with each mark permanently changing the surface on which future marks are to be made. The index made by the Staircase Clock is, by contrast, (almost) completely transient, being reset and remade anew each day. These different timescales of the indexes relate to the different timescales of the everyday situations which they record. The Allotment Calendar places the mundane activity of the allotment within the cosmic context of changing daylight and the year as a whole. It embodies a history of the allotment over a series of years (however long it takes for the marks to grow over) in the same way that the allotment itself is an accumulation of activity through the seasons and year on year. By contrast, the transitory quality of the Staircase Clock reflects the daily repetition of the staircase's use and the daily patterns of the house. While the kitchen table is also a place of daily repetition, time spent here is more varied than at the staircase. It is a place of significant and memorable events through which relationships and friendships develop and I have tried to reflect this in the permanent and additive quality of the marks made by the Toast Rack.

The marks made in each project record aspects of their situation that, because they are temporal, would not otherwise be so directly observable. The most significant aspect of this indexation is, however, not the information presented in the index but the sense of connection that this makes possible. I have criticised the Allotment Calendar for its apparent completeness and the misleading suggestion of objectivity this creates. The other two projects have moved away from this. Rather than the information presented, the significant aspect of each project is the process of

indexation and the connection this expresses. This is similarly the case with the examples of indexical situations I cited above (Figure 16-Figure 19). The potency of the steps at Wells, of the formation of a path in a field or of the historic layering of a city is not to do with the specifics they embody but with the relation between present and past that one can construct using them.

As I have noted in discussing the Staircase Clock, in each of these three projects I have superimposed my proposal onto the existing situation of its context, adding to it rather than changing what is already there. The marking device of the Allotment Calendar is held above the ground by its minimal pergola structure and reaches down to inscribe its surface. The Toast Rack accelerates the gradual scarring of the kitchen table which is already occurring, adding its pattern to an existing surface. The Staircase Clock stands apart from the staircase, recording it but not changing it. This separation might be viewed as a limitation of each project's effectiveness (that they can all be ignored) or as a result of reticence on my part. I see it in terms of being careful towards the existing situation—it is what is already happening in each situation that is of interest to me in each case and I have tried to design each project such that it adds to rather than replaces this. This could be construed as an attempt at objectivity—as a separation of the observer from the observed (both in the sense of the apparent neutrality of my attitude as designer and in the linearity of the recordings by the mechanism) which would be at odds with the position I have taken above. This has been the basis of my criticism of the Allotment Calendar for presenting itself as being complete. However, although these projects are minimal in their impact they each nevertheless transform their context as the act of observation is itself an intervention. Part of our experience of each of these projects is that we observe ourselves being recorded (we see ourselves through the eyes of another, here the measuring devices). It is noticeable that, in these cases, this self-reflection is not reciprocated by the measuring devices themselves which act as what von Foerster (1991, pp. 68-69) has called "trivial machines", reacting predictably and deterministically to their inputs (until they break or malfunction) without changing this in response to their recordings or to their being observed. We, by contrast, act non-trivially in that in observing that we are being recorded we

adjust how we act.[189] Even to not change how we act just because we are being watched is to act differently because it is to conceptualise this action differently. The significance of these measuring devices is therefore not the information that they organise and present but that, in observing them observing us, we are prompted to observe ourselves.

3.1.4 St. Alphage Gardens

3.1.4.1 St. Alphage London Wall

The three projects which I have discussed above have all proposed devices which measure aspects of everyday situations in terms of their frequency and duration and translate these inputs in such a way as to make this act of observation (by the machine) observable (by the onlooker). Each of the three sites are either personal to me or otherwise to someone I knew and so in designing the projects I could assume a degree of familiarity and repetitive experience on behalf of their observers. In the two design proposals that I present in this section, I have transplanted this strategy fairly directly into a more public context. In this setting it is not possible to design with a specific observer in mind or to rely on onlookers becoming familiar with the project over time and I have therefore been concerned with how to make the projects comprehensible given this.

Both proposals in this section are set in St. Alphage Gardens in central London (Figure 52-Figure 61). Unlike previous and later projects I have no personal connection to this site. It does however relate to my interest in indexical situations which I introduced above. While the above three projects relate to the sort of physical traces such as the steps at Wells, the St. Alphage site is an example of how the physical features of a city can be interpreted as an index, containing layers of its own history in juxtaposition to each other (compare Figure 19 and Figure 56).

[189] The distinction is between triviality and non-triviality rather than between human and machine—it is possible to build machines that act non-trivially while we sometimes act, or encourage others to act, trivially (see von Foerster & Poerksen, 2002, pp. 54-63).

The site contains a variety of elements spread over three levels: a fragment of London's Roman city wall; the partial remains of two churches; a quiet section of the Barbican high walk (which is currently scheduled for demolition); and the Salters' Hall (designed by Sir Basil Spence, completed 1976). Of the two churches on the site only fragments remain. The original church, dating from the C11th (Westman, 1987, p. 18), incorporated the city wall into its north side and this is now all that remains. The wall was substantially rebuilt in the C14th and C15th centuries with the new masonry being built on the surviving core of Roman wall (Smith, 2004; Westman, 1987, p. 19). In the C16th, with the dissolution of the monasteries, the parish relocated to what had been the chapel of nearby Elsing Spital, a monastic hospital for the blind, and the first church was demolished leaving only the fragment of city wall remaining. The relocated church survived the Great Fire of London, but, having fallen into disrepair, was rebuilt in the C18th. Damaged by an air raid in the First World War, it was mostly demolished in 1923 leaving only the tower which was gutted by fire, along with much of the surrounding area, in 1940 during the Blitz (Bradley & Pevsner, 1998/2002, p. 55). The remains are now somewhat awkwardly incorporated into the Barbican development, surrounded by the high walk (Figure 56).[190] While these remains are not especially dramatic in themselves they are connected to a variety of historical events: Roman Britain; the Wars of the Roses (this being the reason for the C15th rebuilding of the wall); the dissolution of the monasteries; world wars; modernist architecture; and the preservation movement.

The various elements of the site are split over three separate levels which are connected by two stairs. The lowest level is that of the Salters' Garden, lying to the north of the city wall and facing Spence's building. A small portion of the garden passes through the line of the wall at this lower level from where a stair leads up to the west side of St. Alphage Gardens proper at street level (Figure 61), the site of the first of the two former churches. At the east side of this higher level of garden the other stair passes through the line of the wall leading both down to the Salters' Garden (Figure 58, Figure 59) and also up to high walk with its boarded up shops (Figure 54, Figure 55). The

[190] For an account of its preservation and incorporation within the Barbican development, see Sandes (2008).

two proposals I have made for this site are located one at each of the two stairs at either end of the upper garden.

Figure 52: View of St. Alphage Gardens (upper level garden), looking east.
The wall can be seen to the left.

Figure 53: View of St. Alphage Gardens (upper level garden), looking west.

Figure 54: St. Alphage portion of Barbican highwalk (to the east of the site), looking south from top of staircase. The ruined tower of second church ahead, St. Alphage Gardens to the right, boarded up shops to the left.

Figure 55: St. Alphage portion of Barbican highwalk (to the south of the site), looking east towards ruined tower. Another parade of boarded up shops on the left, London Wall main road to the right.

Figure 56: The layers of the site—London Wall main road, ruined tower of second church, Barbican highwalk, Sir Basil Spence's Salter's Hall beyond.

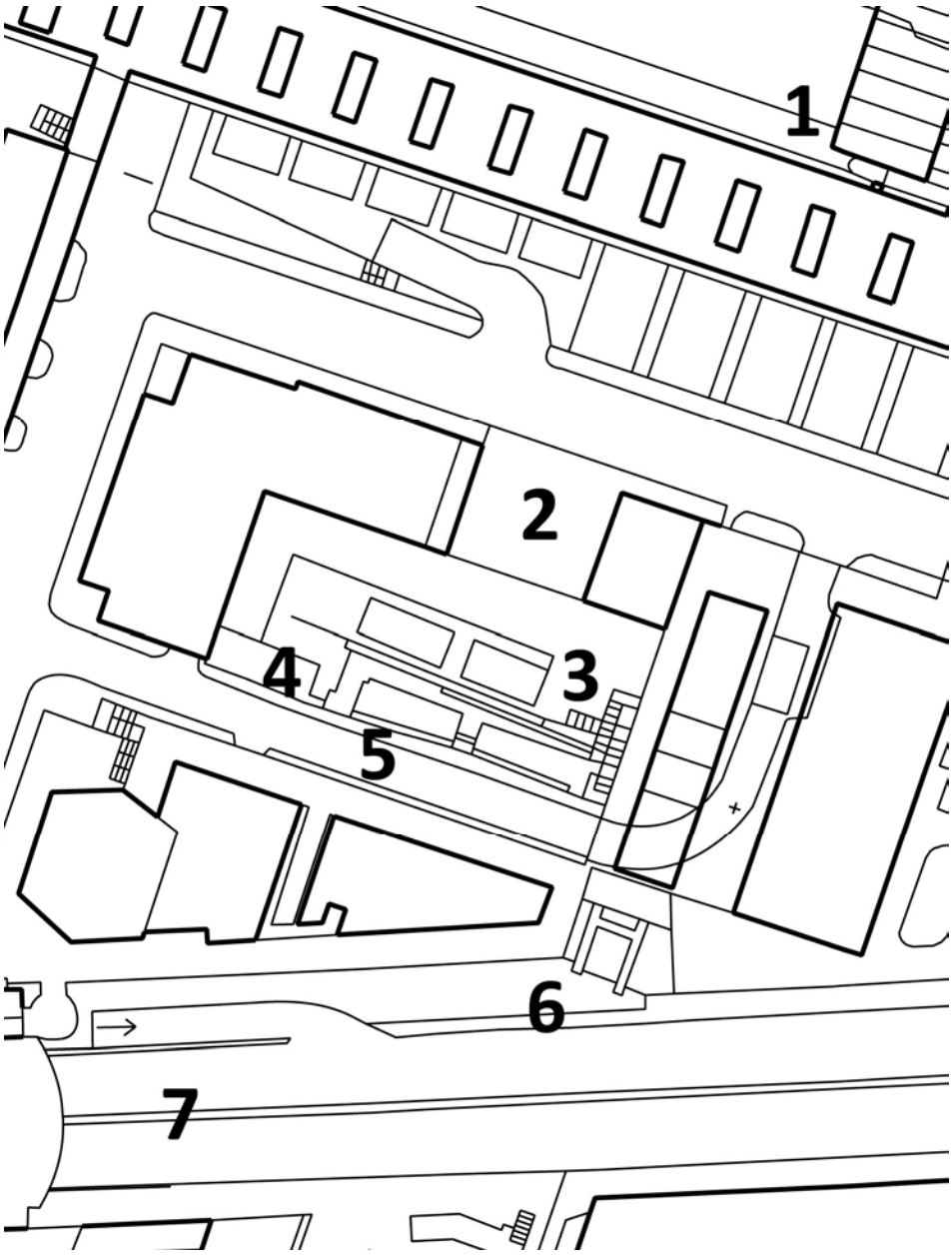

Figure 57: Location plan, St. Alphage Gardens.
1. The Barbican. 2. The Salter's Hall. 3. The east staircase. 4. The west staircase. 5. Site of original church. 6. Ruined tower of second church. 7. London Wall main road. North is up the page.

Figure 58: View of east staircase from Salter's Hall across the Salter's Garden (lower level garden).

Figure 59: View of east staircase and fragment of city wall from Salter's Hall across the Salter's Garden (lower level garden).

Figure 60: View from west end of St. Alphage Gardens (upper level garden) looking west.
The gate leads to the staircase down to the portion of lower level garden on the south side of the wall and is in line with where the west end of the first church stood.

Figure 61: View of west staircase from small lower level garden on south side of wall, looking east.

3.1.4.2 East staircase

The staircase at the east end of the garden descends from the high walk, crossing the line of the adjacent fragment of Roman wall, and with it London's historic boundary, to St. Alphage Gardens before doubling back on itself to descend once more, again crossing the line of the wall, to the Salters' Garden (Figure 58, Figure 59). My proposal for this end of the garden comprises a gantry running parallel to the stair, also crossing the line of the wall, supporting a mechanical spire that would move backwards and forwards along the gantry (Figure 62-Figure 66). The movements of the spire would be caused by passers-by ascending and descending the stairs between the garden and the high walk above. Sensors placed at the top and bottom steps would record the durations of each ascent or descent of the staircase (accepting the resulting inaccuracies from people overtaking or changing direction). These time periods would then determine the motion of the spire which would move for the same length of time and in the same direction as each use of the stair—that is, south, and into London, for descent and north, and out of London, for ascent—but at a much slower pace, travelling only a fraction of the distance of the gantry each time.

The translation of input recordings to the movements of the spire is not a simple replication of present events on the stair but a translation of past events in two different ways (Figure 67). The first set of movements is derived from continually averaging all the recorded durations of ascending and descending the staircase and the intervals between them. These averaged durations and intervals are translated into a regular back and forth pattern. These are not subtracted from each other but rather there are two patterns of movements, one northward (ascent) and one southward (descent) which occur independently. The oscillation which would result would be slower than the stair's busy periods (weekdays; lunchtimes) and quicker than its slowest ones (weekends; overnight).

Assuming that, on average, people take less time to descend rather than ascend the stair, and that the numbers ascending and descending are more or less equal, the spire will eventually become stuck at the north end of the gantry and will need to be reset. After some experimentation the coefficients determining the speed of movement of the spire could be adjusted so that this

resetting could be done seasonally and, like the resetting of the wooden blocks in the Staircase Clock project, with a sense of ceremony marking the passing of time.

This regular backwards and forwards motion is accompanied by a second more sporadic set of movements which the spire also performs. The spire replays the specific recorded ascents and descents from the previous day, moving in the direction and for the duration of the ascents and descents of 24 hours earlier. Whereas the averaging describes a quality of the staircase's use in general, the repeating of yesterday's activity displays specific individual events as a comparison. These two repetitions by the mechanism are played out against the present use of the staircase. In this way any actual ascent or descent of the stair is contextualised both against other specific uses (from yesterday)—and perhaps coinciding directly on occasions, especially if someone's daily movements are extremely regular—and also against an averaged out measure of that activity as a whole.

In composing the elements of the proposal I have been conscious of associating the movement of the spire with the movements of people on the stair so that their connection could be grasped without, or with minimal, explanation, assuming a lack of familiarity with the site. As well as this, the position in which I have placed the gantry, crossing the line of the wall between the two gardens, emphasises the significance of the stair's position, crossing the line of the wall. The measurement of movement on the stair, similarly to the Allotment Calendar, highlights both the regularity of the use of the stair and also how individual moments vary from this pattern. More explicitly than the earlier projects, the significance of this is not the information which it presents but that passers-by might notice themselves and others being observed, leading to them becoming more conscious of their own presence. By encouraging us to reflect on our presence on the stair and within the immediate history of its use, and by emphasising the stair's position crossing London's historic boundary, I imagine the spire's movements might also prompt us to reflect on our presence within the history of the site as a whole.

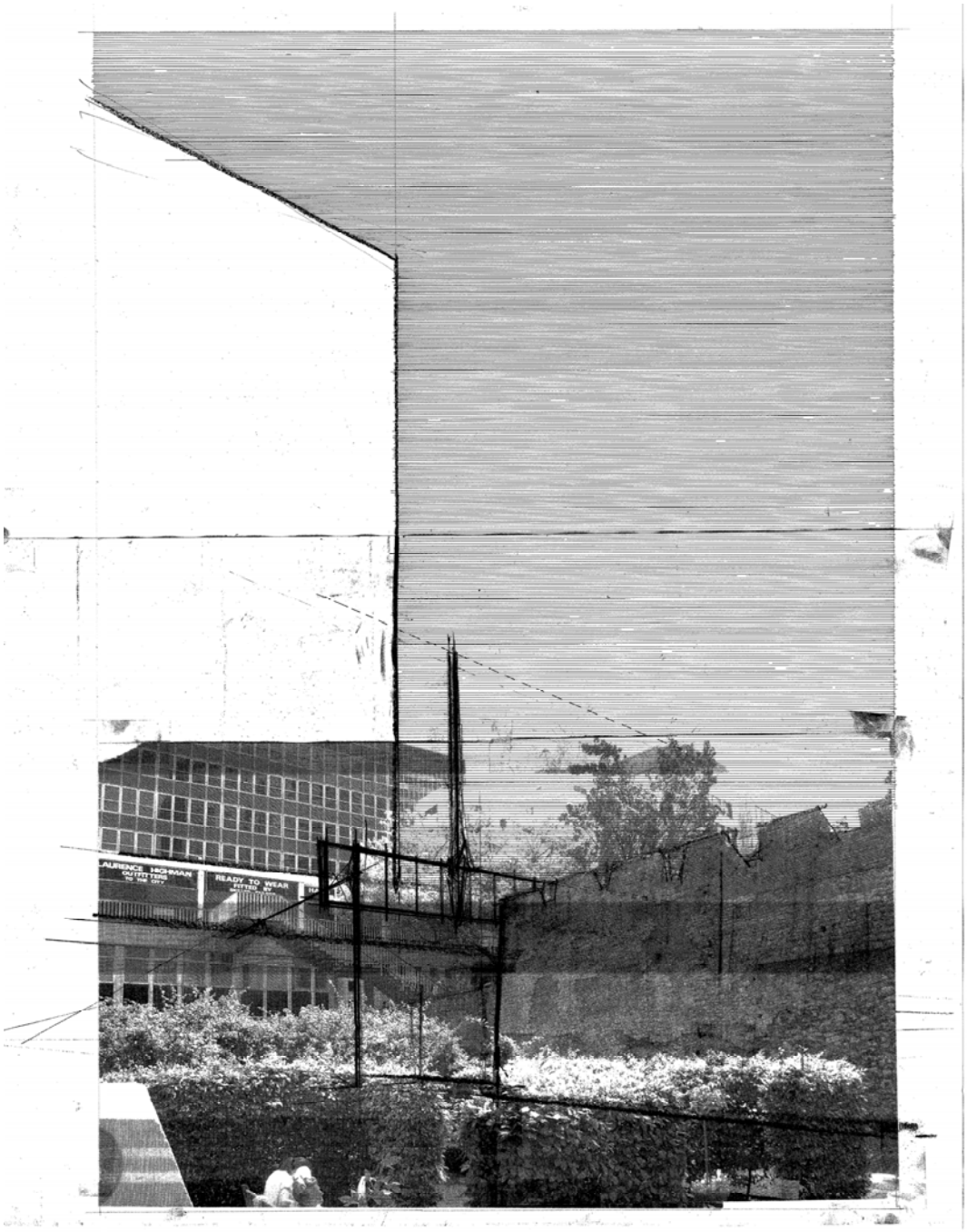

Figure 62: Proposed gantry and mechanical spire, view from the Salter's Garden.[191]

[191] The drawings in this project are mostly made differently to those of previous projects, incorporating collaged elements of the site (reflecting what I see as its fragmentary nature, see section 3.1.4.4 below) and working over these with a combination of pencil work, tracing paper and photocopying, with only a little pen work. The placement of different layers of tracing paper both provides a surface on which to draw and also interferes with the photocopying process to emphasise particular areas of the drawings.

Figure 63: Proposed gantry and mechanical spire, sectional perspective, from the Salter's Garden.

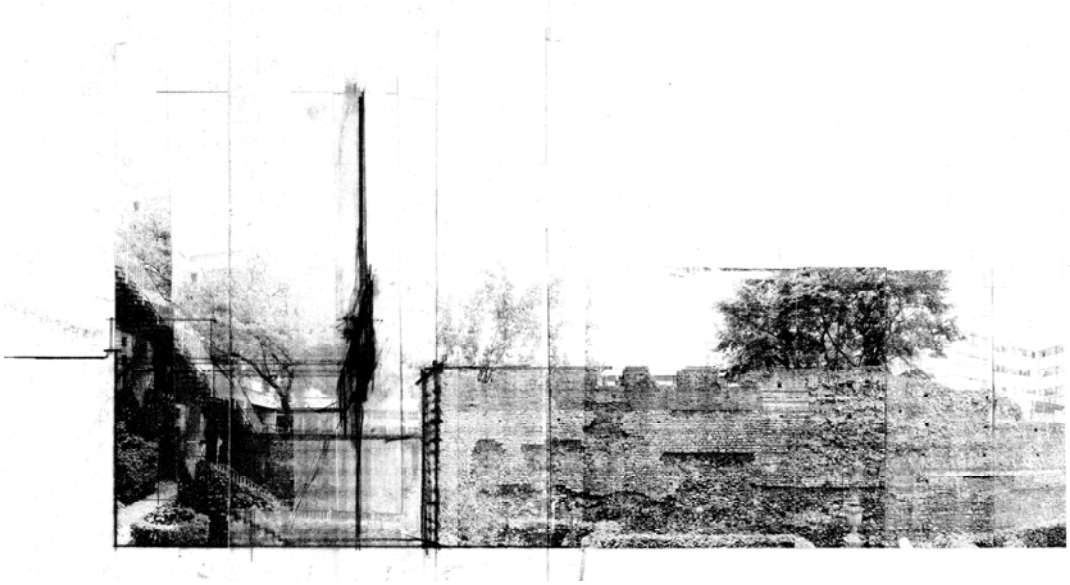

Figure 64: Proposed gantry and mechanical spire, section looking south towards fragment of city wall from the Salter's Garden.

Figure 65: Proposed gantry and mechanical spire, section looking north towards the fragment of city wall from upper level garden.

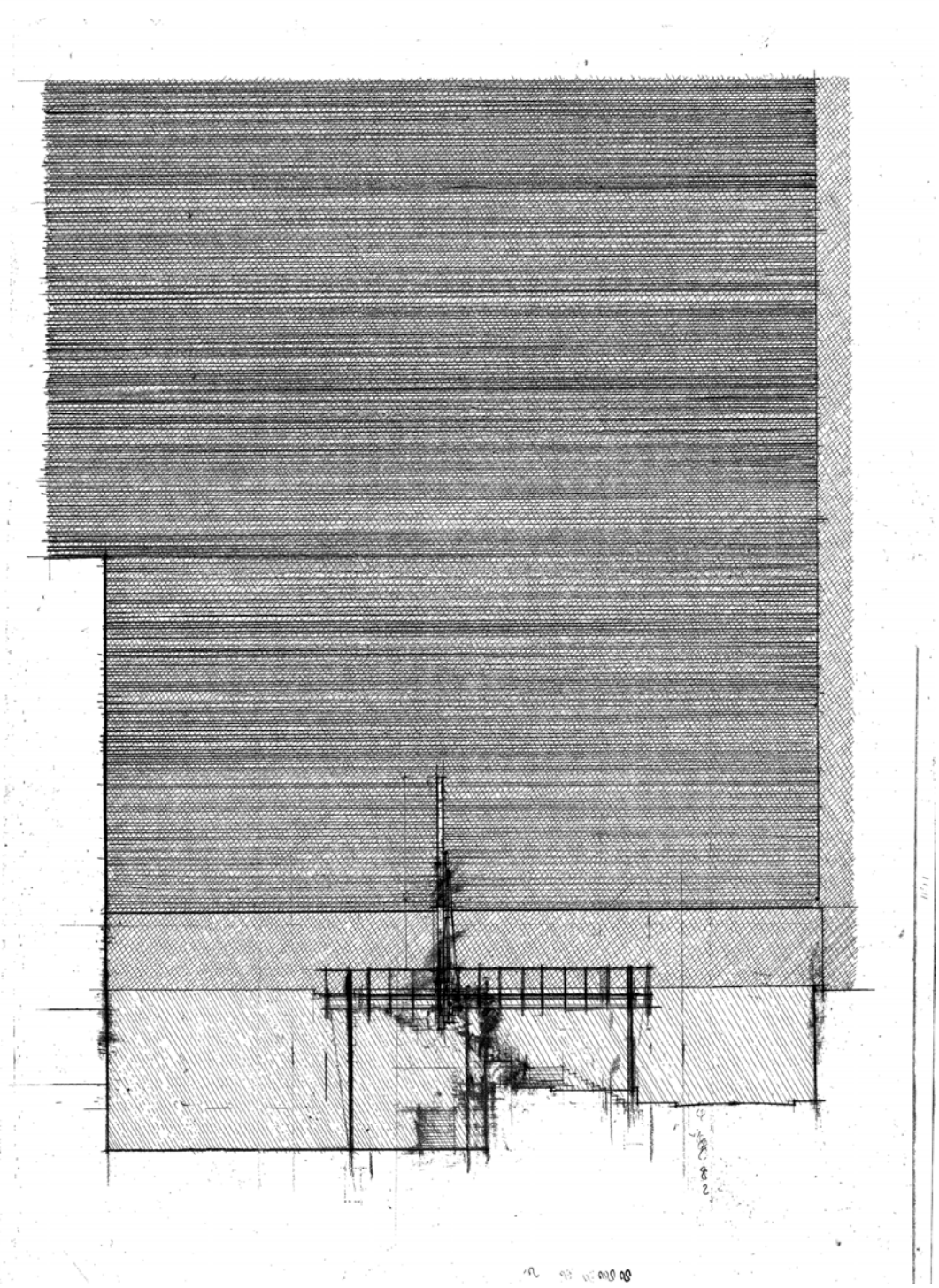

Figure 66: Proposed gantry and mechanical spire, section looking east.

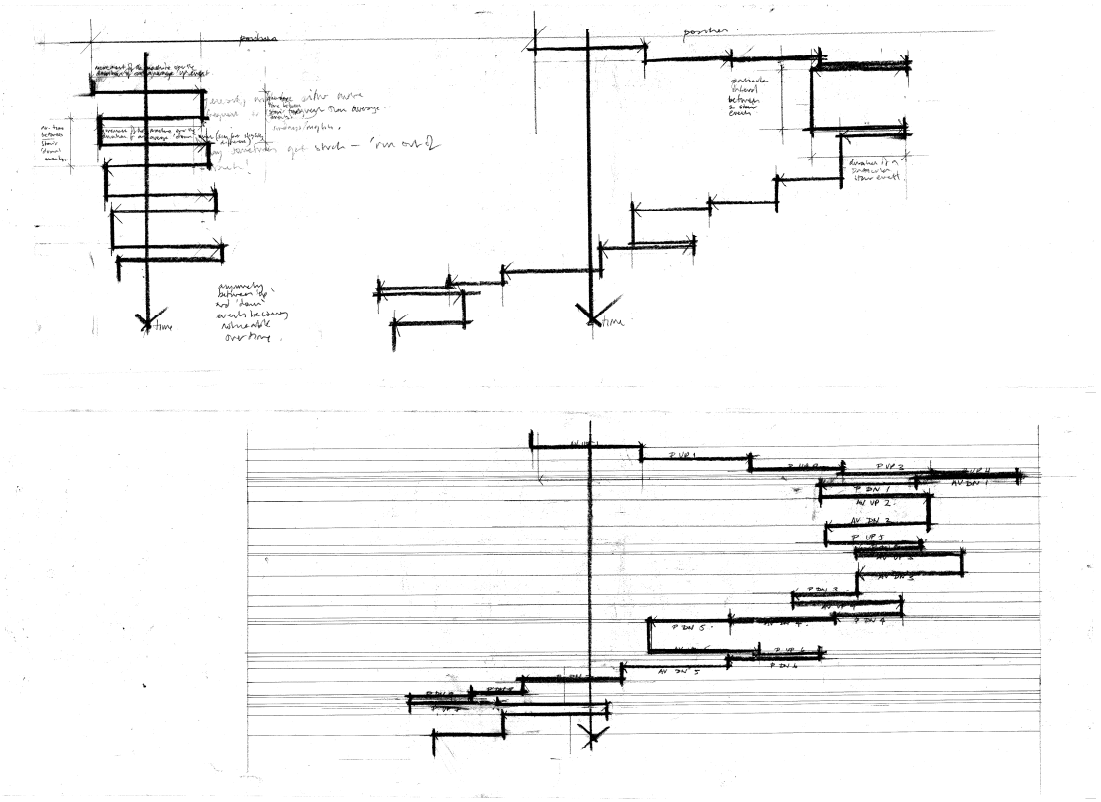

Figure 67: Diagrams indicating movements of the spire.

The top two diagrams show the two different components of the spire's movements. Horizontal arrows indicate movements of the spire for a duration equivalent to the length of the line. Vertical lines indicate no movements, again for a duration equivalent to the lengths of the line.

The top left diagram shows an example of the regular back and forth motion of the spire's performance of the average ascent and descent durations at the average interval between ascents and descents. Assuming roughly equal numbers of ascents and descents and a slightly longer average duration for ascent than descent, the gantry would slowly edge northwards.

The top right diagram shows an example of a series of particular ascents and descents of the staircase from the day before. The pattern of left and right is irregular and the durations of movement are all different.

The bottom diagram superimposes the other two diagrams and indicates the sort of pattern of movement the spire would act out, with its regular back and forth motion being moved around somewhat arbitrarily in accordance with events of 24 hours earlier.

3.1.4.3 West staircase

The second staircase is located at the west end of the street level garden to the south side of the city wall. The stair passes down to the portion of the lower level Salters' Garden which lies to the south of the line of the wall (Figure 61)—at what was the west end of the original medieval church of St. Alphage London Wall (for the form of the original church see Westman, 1987). My proposal at this stair consists of a portico spanning over the stair between the higher and lower levels of garden (Figure 68-Figure 71). Each column of the portico holds a chime of varying lengths (and therefore varying pitches).

The mechanism which strikes the chimes is operated by sensors on each tread of the stair such that each time a tread is stepped on the wheel at the first column turns causing a hammer to strike the adjacent chime. A set of 1:2 and 1:3 ratio gears transfer the rotational movement of this first wheel along the portico, adjusting the rotation speed of the wheels at each chime. While the first chime will strike with each step on the stair, the second will strike with every third step, the third with every sixth, the fourth with every eighteenth (the number of steps in the stair, i.e. it would strike once for each person walking up or down the stair), the fifth every thirty-sixth (every second person walking up or down the stair) and so on. The last chime (the fourteenth) would strike only after 1296 completed journeys up and down the stair (23328 steps).[192] The rarer chimes to ring are tuned to lower pitches, the more common ones to higher pitches. Ascending and descending the stair one would therefore be accompanied by a regular ringing of the higher pitched chimes, with the more occasional accompaniment of the medium pitched ones. Very rarely one might be taken by surprise by one of the lower chimes.

Similarly to the project at the east staircase, the mundane act of ascending and descending the staircase is made more noticeable, encouraging passers-by to observe their own presence in this place. The space created by the portico frames this activity and locates it in the site by connecting it

[192] There is no numerological symbolism intended here; the ratios were chosen because they created a set of intervals that fitted well with the eighteen steps in the staircase.

to both the upper and lower levels. The portico completes the west end of the upper garden, running along the line of what would have been the now absent church's west wall. Whereas currently the garden feels like a space between the wall and the street, creating height on this side forms it into more of a three dimensional volume (Figure 71) and recalls the internal space of the long demolished church. The portico could therefore be thought of as a narthex (appropriately positioned at the west end) to the absent church.

Figure 68: Proposed portico and chimes, west staircase, section looking north towards the fragment of city wall.

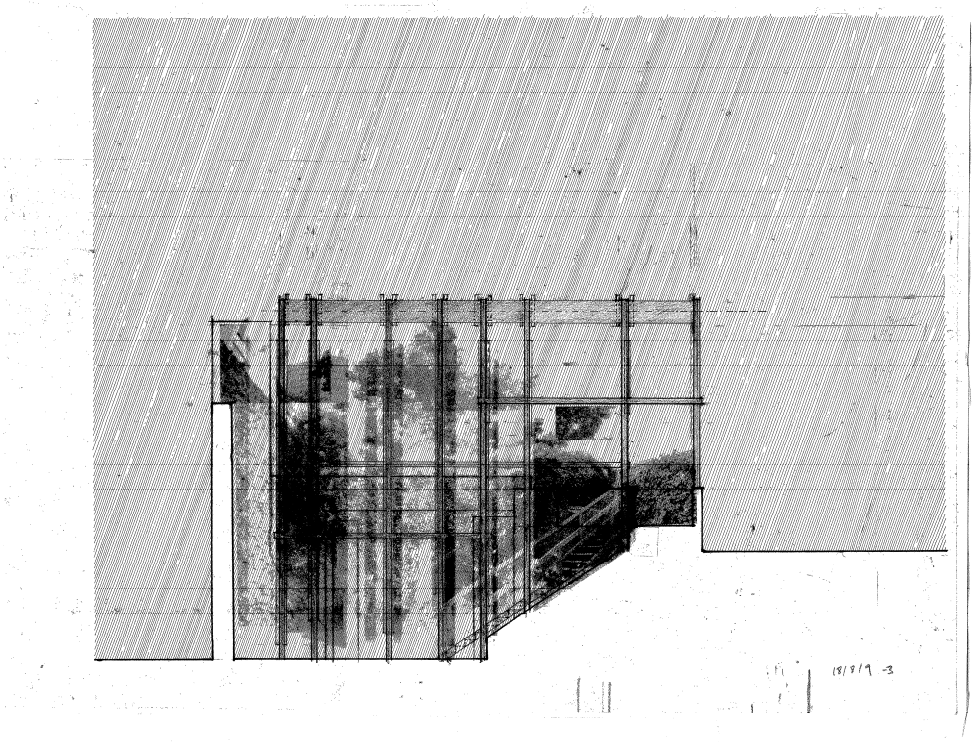

Figure 69: Proposed portico and chimes, west staircase, section through low level garden, looking east towards upper garden.

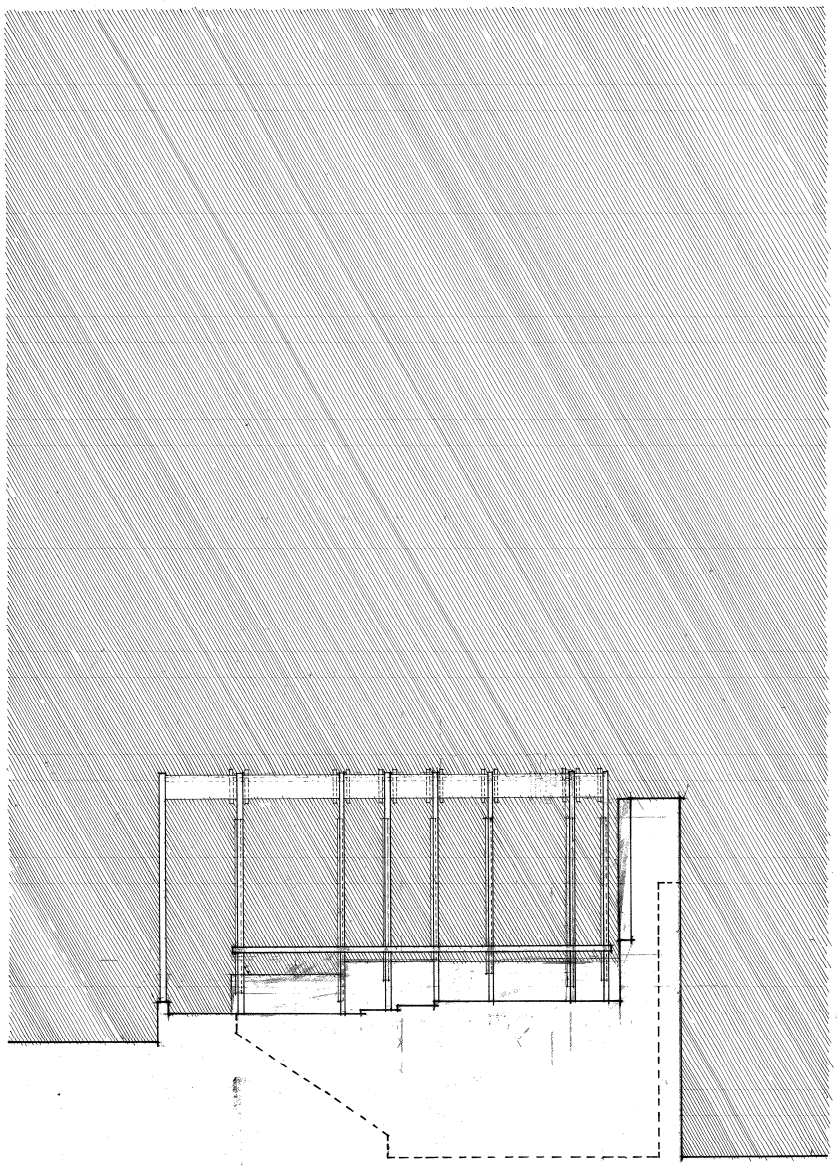

Figure 70: Proposed portico and chimes, west staircase, elevation to upper level garden.

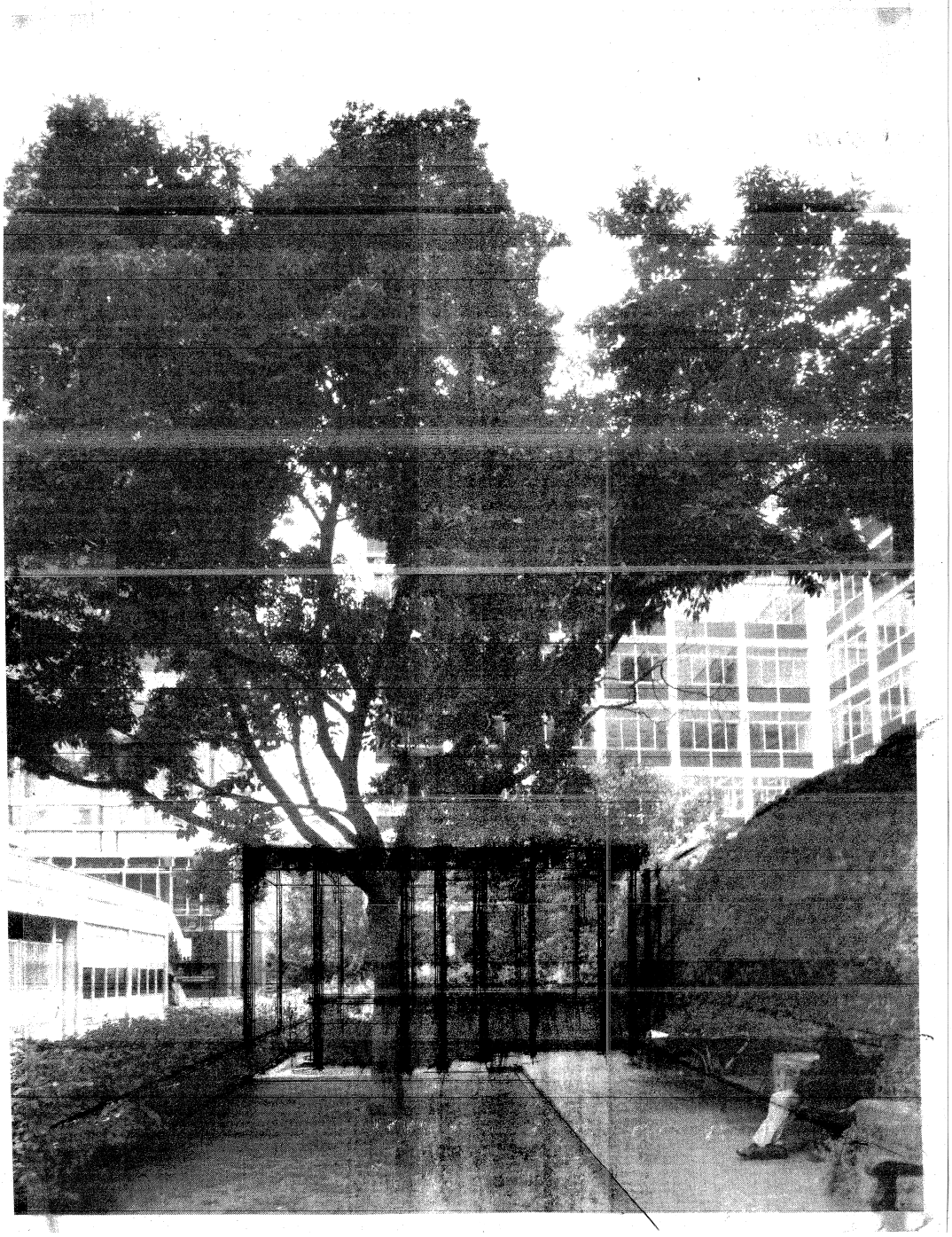

Figure 71: Proposed portico and chimes, west staircase, view from upper level garden.

3.1.4.4 Comment: Machines and fragments

Similarly to the Allotment Calendar, Toast Rack and Staircase Clock projects, the devices I have proposed for St. Alphage Gardens respond, via some rather blunt measurements, to patterns of everyday events in such a way as to highlight their rhythm and the observer's presence in the situation. Whereas the previous projects had created physical records of these patterns (the Allotment project had inscribed it into the ground; the Toast Rack marked it into the table top; the Staircase Clock had reflected it in its arrangement of blocks), the index here is more immediate, being translated into movements or sounds. Given this and the lack of familiarity that, with the public nature of the site, is to be assumed in the observer, I have been particularly concerned with making the indexical process discernible. It is for this reason that I have included conspicuously mechanical components (the spire, the gear wheels) in the projects, as the explicitness of such physical mechanisms is expressive of the processes they act out. In the second project the inputs to the mechanism are via electronic sensors and these could be made to activate the hammer for each chime at the appropriate ratio. However, whereas electronic causal connections cannot be observed, the physically mechanical connections between the different chimes make their causal connection, and their ratio, observable.

While I have included mechanical components in these proposals primarily due to their expressiveness, they also bring their own symbolic content. Machines are widely invoked in art and architecture and have all kinds of associations.[193] This is not just because of their aesthetic qualities

[193] Part of my exploration of this topic has been a collaborative exhibition that I organised and curated, entitled Invisible Machines, which was held at Grand Parade, Brighton (8th December 2010 to 7th January 2011) with a post-exhibition event at RARA (the Redundant Architects Recreation Association), London (4th June 2011). The idea of this was to bring together a range of different perspectives so to explore what is a vast topic through finding relationships between our different understandings of it. In addition to myself there were seven participants. Some were interested in machines in a very physical sense (Tom Foulsham's various balances; Michael Wihart's pneumatic and hydraulic devices) while others used machines in proposing and making architecture (Mike Aling through the medium of film; Glenn Longden-Thurgood with projection) or explored various themes of machines in architecture through drawing and modelling (Tim Norman's pataphysical studies of the celestial mechanics of the cosmos; Ersi Ioannidou's reflections on the notion of the

but also because of the way that they can be both something actual (such as a physical device) and also something abstract (as understood in cybernetics) and so can be interpreted as physical manifestations of abstract ideas (that is, as symbols). The abstract sense of a machine can be thought of in terms of relationships between things and, given that, as Bateson (1972/2000, pp. 150-151, 470) notes, it is with matters of relationships that we are most concerned, machines can be used as metaphors for a wide variety of potent topics.[194]

The aspect of machines that is most relevant to my topic is their association with rationalism, that is, with the sorts of abstract mechanisms of logical inferences. This can be meant in two slightly different ways. Firstly, we expect a machine to do something (to be functional) and to be efficient in how it does it and so to be rational in the sense of planned and ordered. Secondly, the tendency of machines to be deterministic and predictable can be interpreted as embodying the equivalent abstract mechanisms such as deduction in physical form—such as, for example, the way that Babbage's mechanical computers perform abstract mathematical procedures.[195] Both these two senses can be meant in both positive and negative senses. For something to work efficiently, "like a well-oiled machine", can sometimes be dehumanising. Similarly, logical reasoning is both a requirement of clear thinking and can also sometimes lead to the slavish following of rules where this lacks compassion, emotion or common sense (such as Crane's (1995/2003, pp. 118-123)

---

house as a machine; Charlotte Raleigh's drawings of the ecological relationships of bumblebees). Bringing our different work together generated discussions about possible connections and so of the relationships between these different notions of machine in the context of architecture. For a more detailed account, see the post-exhibition catalogue (Sweeting, 2011b) which we assembled as an archive and record.

[194] I think especially of Duchamp's Large Glass, which carries a seemingly inexhaustible potential for symbolic interpretation and is simultaneously interpretable as being concerned with sexual desire (Clair & Szeemann, 1975), the cosmos (Paz, 1968/1990, pp. 57, 109) and science (Henderson, 1998). It is perhaps best thought of as a "machine for *producing meanings*" (Paz, 1968/1990, p. 86).

[195] This is the "trivial" sense of machine (von Foerster, 1991, p. 69). While cybernetics can be defined as the study of "all possible machines" (Ashby, 1956/1964) this is not limited to trivial ones but also includes non-trivial, or non-deterministic, mechanisms. That we often associate the terms machine and mechanical with trivial or deterministic processes only is a source of one way cybernetics is often misunderstood.

example of the bus driver; see section 2.1.2.2 above). This ambiguity is a quality of the autonomy of machines, which is both characteristic of unthinking objectivity and also of subjective agency.[196] This is reflected by the two contrasting senses in which it is possible to speak about the aesthetic of machines: in terms of (1) the clean lines of the rational and efficient machine and (2) the inversion of this aesthetic in over-complication, inefficiency or impracticality creating tension with its expected efficiency.

The proposals described above for St. Alphage gardens fit with this second version of the aesthetic of machines. The technology used is out-dated, overly elaborate and has no functional use. Understood in this way, there is a similarity between the mechanisms that I have proposed and the other layers of the site. All are fragments, reminding us of greater wholes.[197] In the case of the ruins of the wall and the churches this sense of fragment is physical and literal while the high walk is a fragment in that it is incomplete because of its disuse. The mechanism is however a fragment in a different sort of sense. It reminds us of the rationalism and determinism associated with machines but (because of its over-complication) does so in such a way that it does not just reference these ideas but also contrasts with them. Understanding the mechanisms as an additional layer of similar status to the other historical fragments of the site invites a comparison between them. Like the mechanism they are not just fragments in terms of being parts of now lost structures but can also be read as fragments of the thinking that was embodied in them. The ruined wall is not just a fragment of an ancient structure of historical significance but of a lost civic infrastructure. Similarly, the ruined churches remind us not just of the lost buildings but also of the dissipation of the unified religious order which they had once represented (especially given their association with the dissolution of the

---

[196] This tension is explored by, for instance, Asimov's robot stories. Asimov's three laws of robotics describe how a machine might reason and his stories explore issues of subjectivity and the paradoxes created by rules—such as in "Runaround" where the robot Speedy, because the second and third laws have conflicted with each other, acts as if drunk, wandering in a circle quoting Gilbert and Sullivan, unable to resolve between the two conflicting requirements (Asimov, 1950/1968, pp. 33-51).

[197] On the fragment in architecture, see Vesely (2004, pp. 316-352).

monasteries and so the Reformation). The boarded up high walk expresses the abandonment of modernist principles, such as the separation of function, which inspired it.

The way that the two proposals I have made for St. Alphage Gardens revise the possible meaning of this context is therefore not just a matter of the introduction of new elements but of how these re-contextualise their surroundings. This is an example of the hermeneutic circle—where the parts revise the meaning of their context and the context revises the meaning of its parts—and it is also the case with the Allotment Calendar, Toast Rack and Staircase Clock projects to some extent. As well as a series of different historical layers, the site can also be understood as the remains of lost authorities or orders (civic, religious, functional, rationalist). Thus the project refers to the idea of us being part of the world and undecidability not just in its indexation of our presence (like the Allotment Calendar, Toast Rack and Staircase Clock) but also in the understanding it allows us to create of the site—of the limitations of those authorities which have historically claimed to make the undecidable questions with which they are concerned decidable.

The understanding of the project I have presented here is one I have developed while working on it and also subsequently in reflecting upon it. I did not understand the site in this particular way before I had made my design proposals and imagined how these would change it. I now see this as being a possible interpretation of the site as it is currently (that is, without my proposals). In terms of the account of the design process I have given above, I have analysed the situation (here the site and its history) through making a proposal within it. Had I made alternative proposals these may well have led to other possible interpretations of their context.

3.2 Constructing the world's presence around us

3.2.1 The world of our spatial experience

In this section I present the second of the two design investigations which I have carried out in response to the spatial and architectural sense of our being part of the world. Whereas in the first I have mostly been concerned with the registration of our presence within the world, here I have focused on our construction of the world of which we are part.[198] The sense in which I have used the term "construction" here has two different meanings. Firstly there is the epistemological sense in which we construct our experience of the world and, secondly, there is the architectural sense in which we construct the environment in which our experience takes place. These two senses are quite different to each other—one being epistemological, the other physical.[199] There are, however, connections between them. Firstly, our physical construction of the world affects our experience and so the understandings that we construct of it. Secondly, the design process is both an epistemologically constructive process and one concerned with the construction of the physical world, while also being a spatially constructive activity itself (drawings and models do not just propose space but are spatial themselves).

As well as these general connections, there is also the sense that in physically constructing spaces we sometimes wish them to reflect the understanding of the world that we have constructed epistemologically, for instance in reflecting our understanding of the cosmos or of our culture. Traditional examples of this include, for instance, buildings such as the Roman Pantheon, the Medici Chapel or the geometrical symbolism of the Baroque. These are notable for reflecting spatial as well

---

[198] There are terminological complications that arise in doing this in the framework of a constructivist epistemology. In this section I have largely refrained from qualifying everything in terms of the world of our experience. I return to this point, and to the difficulty of the implicit realism in this sort of account, below in section 3.2.4.

[199] There is not a conflict between a radical constructivist epistemology and speaking of the physicality of the built environment. Speaking of actual qualities such as materiality does not imply the existence of a world separate to us, as it is possible to distinguish between actual and abstract within our experience. The confusion of the real with the actual can however give this impression.

as spiritual understandings of the world. While the religious orders and cosmological understandings that such buildings embodied have long since dissipated, they reflect aspects of our spatial experience of the world that are still relevant. An example of such an understanding is the way our experience is always via our embodiment within the world, occupying one moving vantage point and that (for the most part at least) we are bound to the earth, underneath the sky (see for instance Norberg-Schulz, 1971, pp. 17-36). This is not a description of the world itself but of aspects of our experience of it, or, more precisely, of what we, given our experience, construct as being common to our experience and to that of others. As these are qualities, not of the world, but of our experience of it, there can be no exhaustive list of such features as they are constantly being formed by us and by our culture (Vesely, 2004, p. 384).[200] It is however possible to highlight some of those spatial ideas which have most demonstrably influenced our culture and language, such as, for instance: the typical situations of the everyday (Vesely, 2004, pp. 77-79, 378-384); the numerous spatial associations in our language (Harries, 1997, pp. 180-200; Norberg-Schulz, 1971, p. 21); and the enduring symbolic quality of natural phenomena such as light and the cardinal points (Harries, 1997, p. 178; Norberg-Schulz, 1971, p. 22).

Traditionally architecture has often reflected the world of which it is a part. This has sometimes been implicit, through the way that typical situations, technologies and vernacular architecture are influenced by cosmological conditions, and sometimes explicit, in the way that some buildings have been conceived as microcosms of the world (often religious buildings but also, as Yates (1969) argues, theatres). Vesely (2004, 2010) proposes that a similar expression of what is common in our spatial experience can provide continuity of reference for our culture (in contrast to what he identifies as the divide between objectivity and subjectivity) in such a way that architecture can fulfil what he sees as its traditional communicative role, which he describes with the analogy that "what the book is to literacy, so architecture is to culture as a whole" (2004, p. 8).

[200] To say that such qualities are culturally constructed is a form of trivial rather than radical constructivism. It is possible, however, to make a similar point using von Foerster's (1991, pp. 72-73) metaphor of eigen-behaviours.

Vesely has used the term “latent world” (2004, pp. 378-379; 2010) to describe aspects of our experience such as these in the sense that they are things that we all share but that we are not necessarily conscious of. It is in the nature of such qualities that they can be found everywhere (this being their significance and also the reason that identifying them often seems anticlimactic) yet in some places we become more aware of them or find them more significant. In beginning these projects I looked for places within my everyday experience where I found these qualities to be present although not totally explicit. I settled on two sites: firstly, a café which I would regularly visit, which, sitting underneath a railway viaduct, has a strong sense of horizontality and verticality; secondly, a particular place within Hackney Churchyard through which I would walk each day and where I would often become particularly aware of the movement of the sun from east to west in relation to other aspects of the site.

That I found it possible to understand these two places in these terms does not mean that either is an especially moving instance of these spatial qualities or that these qualities are objective properties of these situations but, rather, just that when I made a deliberate effort to interpret them in these terms I found that they viably sustained this interpretation. The task of the architectural interventions that I propose is to emphasise this reading so that it becomes viable without requiring such wilfulness in observation in a similar way that the proposals I made for St. Alphage Gardens re-ordered the possible meaning of that site in a way which, while possible beforehand, is strengthened by their addition.

3.2.2 Café Bohemia

Café Bohemia was a favourite haunt of mine during the years I lived in Hackney. It sits in an arch of the railway viaduct near Hackney Central station (Figure 72, Figure 73). My interest in this place as somewhere that articulated our being part of the world, is partly because of its function as a café and partly because of the proportions of its space. A café is one of the most typically given examples of a typical everyday situation (see for instance Aragon, 1926/1994, pp. 24-38; Perec, 1975/2010; Vesely, 2004, pp. 77-79) and also reminds us of the physicality of our body and so of our embodiment in the world. My choice of Café Bohemia in particular was because of the spatial

qualities of its location under the railway viaduct. The railway creates a horizontal datum (a railway being by its nature level, give or take an incline so gradual as to be imperceptible) dividing the everyday world of the café below from that of the sky and the railway above. The main body of the cafe sits under the arch of the viaduct but one can also pass through to an area at the back, on the far side of the railway where a glazed roof lets in light from above (Figure 74, Figure 75). This is generally where I would sit, looking back at the rest of the cafe. This space, with the arch of the viaduct visible and with light and the (surprisingly faint) sound of passing trains coming from above, has a vertical emphasis breaking through the datum while also allowing its horizontality to be perceived.

My proposal for this site is to emphasise the verticality of this rear space and, in so doing, to express the horizontality of the viaduct's datum (Figure 76-Figure 89). In the final iteration of the project, I have proposed raising the roof level of the rear area in order to enclose a space above the datum of the railway line, reflecting that below. Whereas the verticality of the existing space is currently due only to light and sound from above, having the volume of the space break through the datum will allow it to be observed as a division of space within the café. While some of my earlier sketches for this project (Figure 76-Figure 79) suggested more complex geometries I have settled on a plain cubic volume in order to mirror the space of the café below.

The walls enclosing the volume above the datum are solid to the north (towards the railway), east and west but glazed to the south. Occupying the volume above the datum I propose placing 12 hanging weights held by cables from above. The weights would catch the sunlight entering from the south-facing window and cast shadows onto the wall opposite. The weights hang from three beams which, working like levers, span from a pin joint with the main structural columns at the window side and a damped spring connection with the roof structure. They are each then connected to the sleepers of the railway track. As trains pass and the track is loaded, pressing down into the ballast, this slight movement is transferred to the weights, which would swing gently. By emphasising the passing of trains above, my intention is to further express the horizontal datum of the viaduct and the verticality of the space that crosses it and so these qualities of space in relation to the everyday world of the café.

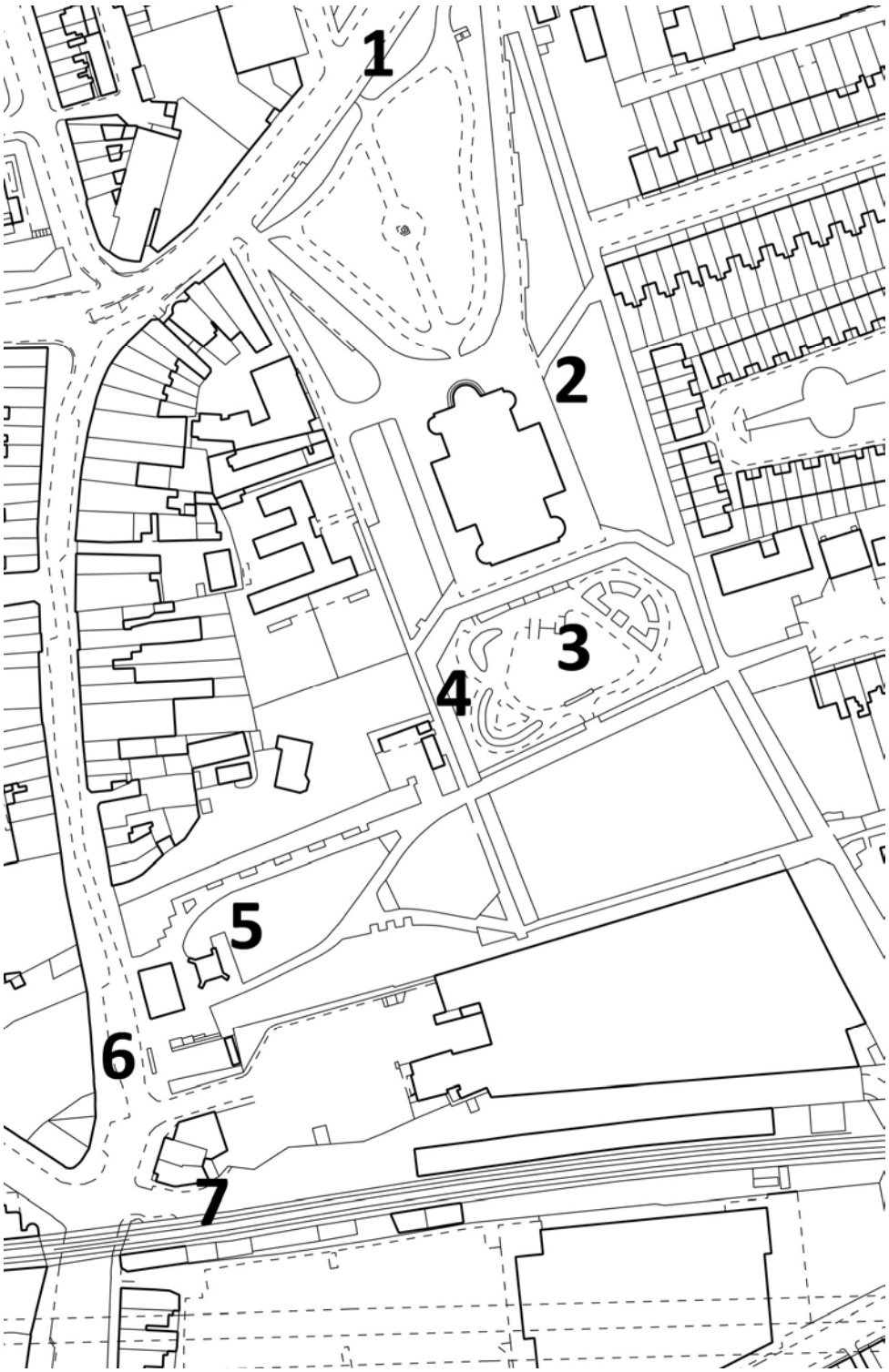

Figure 72: Location plan, Hackney Central, for Café Bohemia and Hackney Churchyard projects.
1. Lower Clapton Road. 2. Church of St. John-at-Hackney. 3. Walled garden. 4. West gate to walled garden—site for Hackney Churchyard project, see section 3.2.3 below. 5. Site of original medieval church (of which remains only St. Augustine's Tower). 6. Narrow Way. 7. Café Bohemia (under railway viaduct). North is up the page.

Figure 73: Cafe Bohemia, exterior view, view from Narrow Way.

Figure 74: Cafe Bohemia, interior view, view from doorway.

Figure 75: Cafe Bohemia, view of top lit back area beyond viaduct.

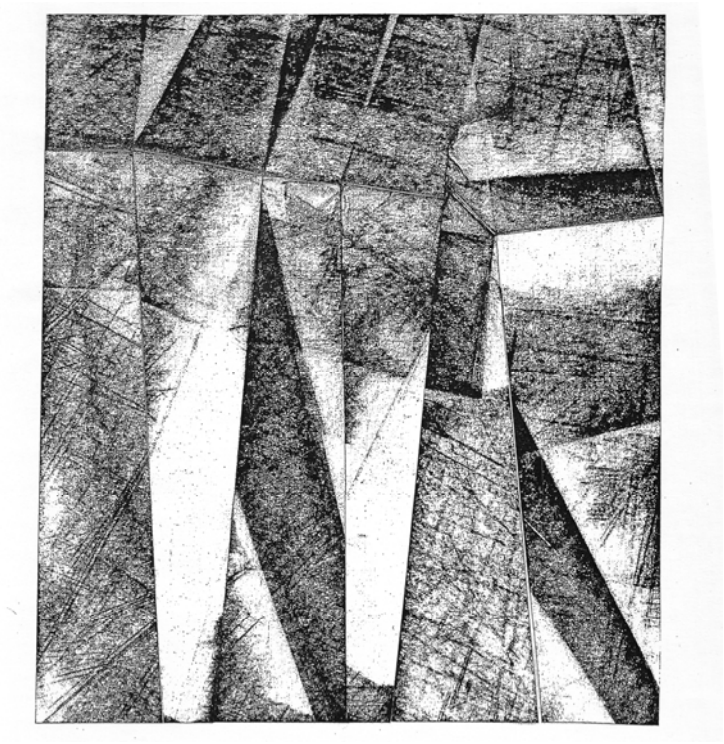

Figure 76: Study of light and texture (1).
These and the following drawings are some of a series of studies made using a rubbing technique with folded paper.

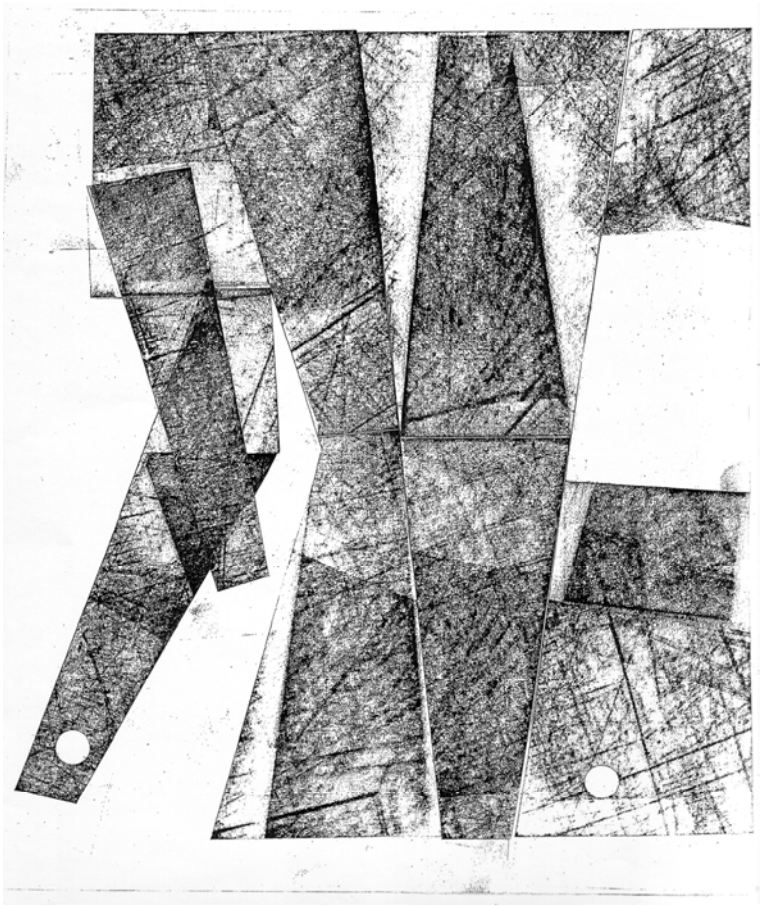

Figure 77: Study of light and texture (2).

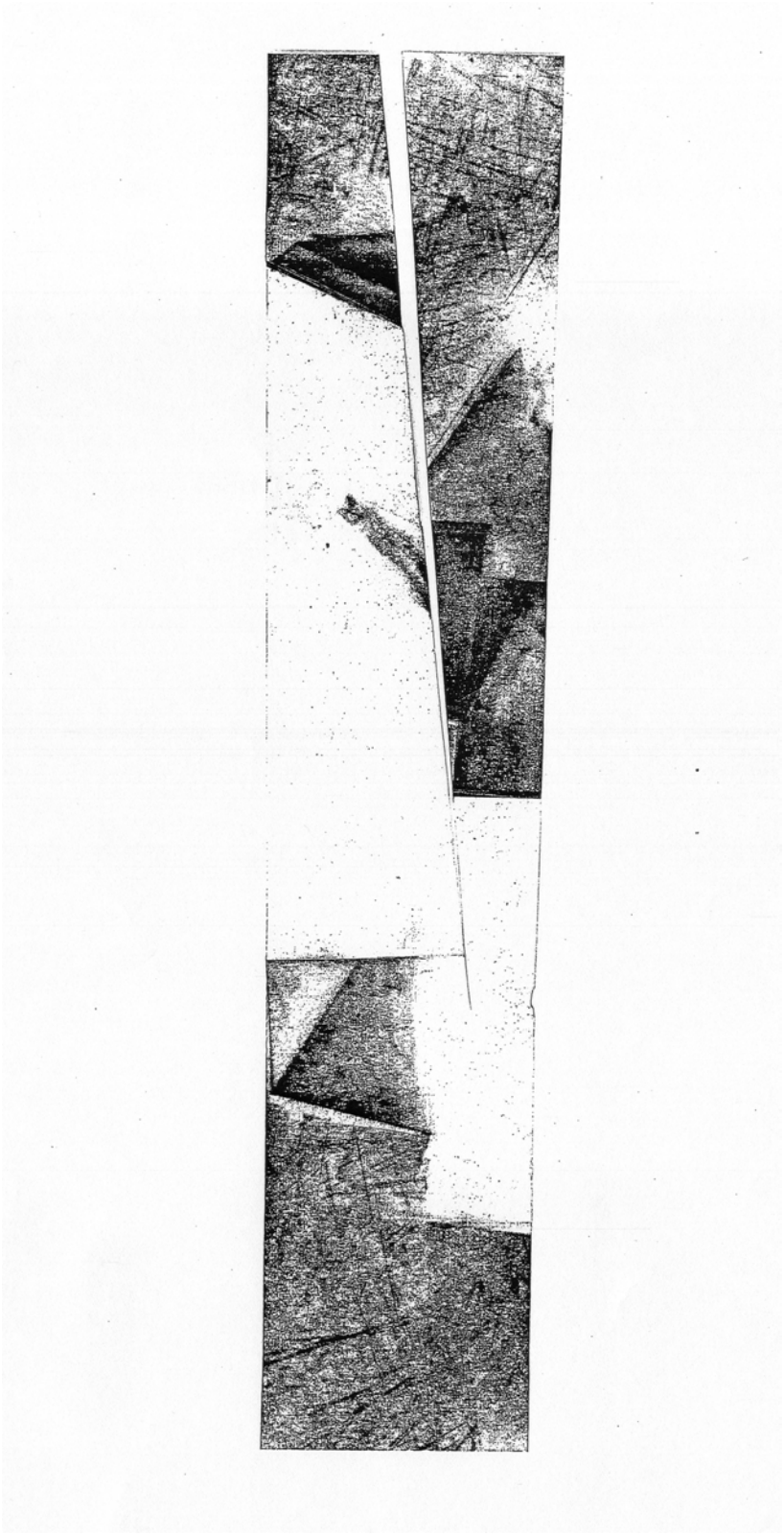

Figure 78: Study of light and texture (3).

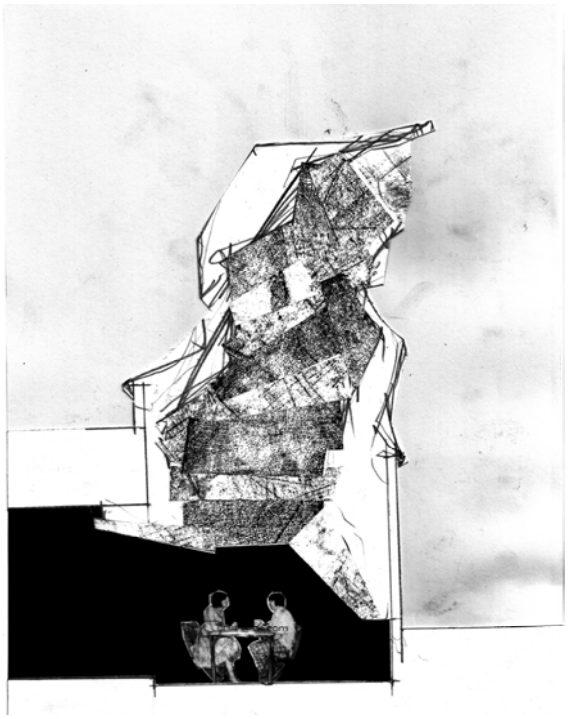

Figure 79: Collage study (1).

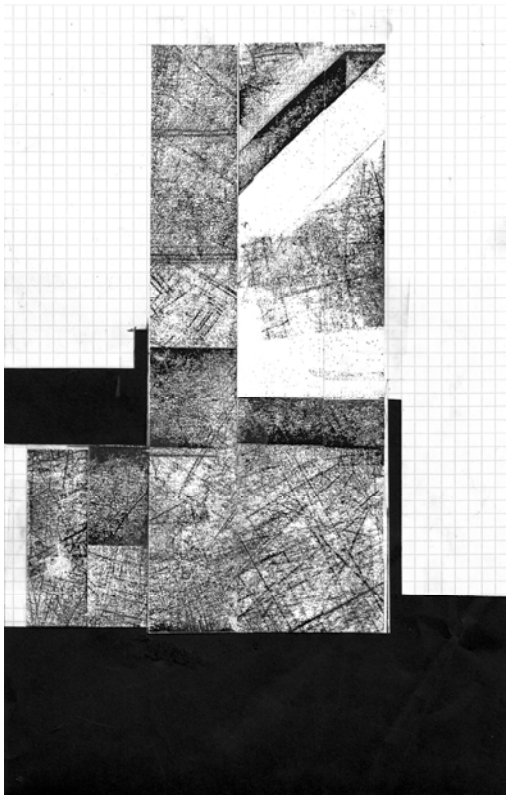

Figure 80: Collage study (2).

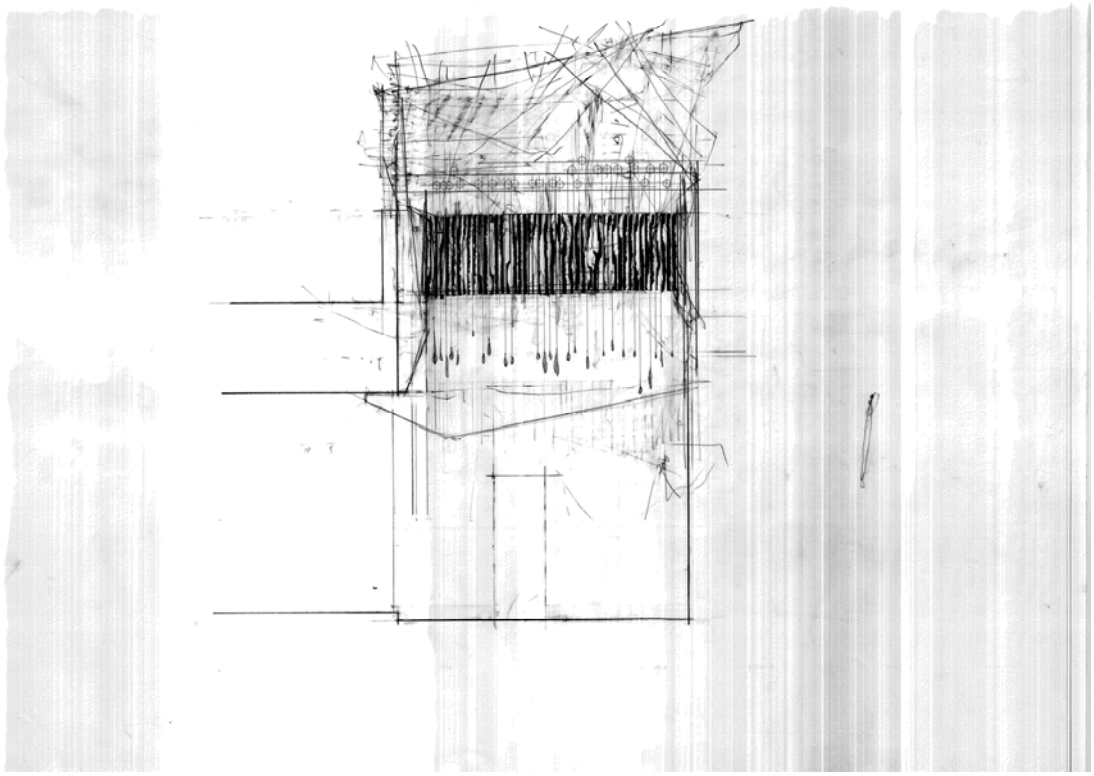

Figure 81: First iteration, section.

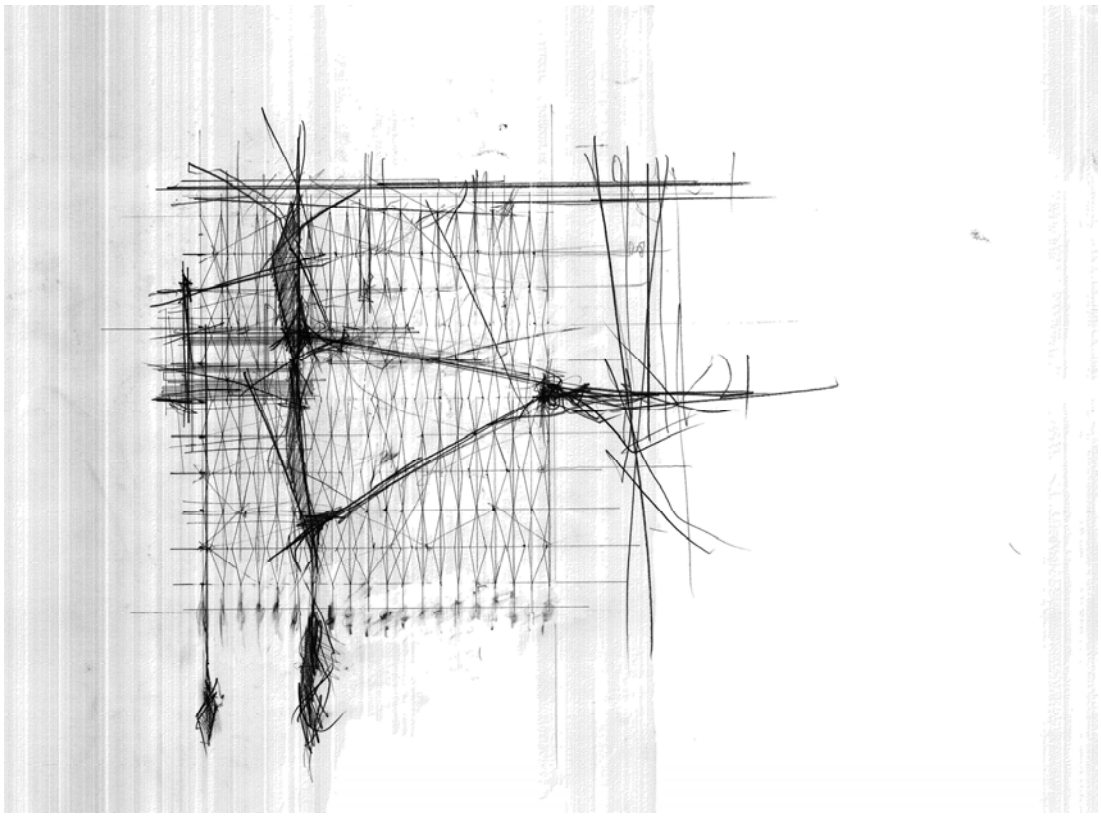

Figure 82: First iteration, study for mechanism (1).
This and the other mechanism studies are the forerunner of the hanging columns in the final scheme. In the same way that I have toned down my initial ideas for the geometry of the upper space, I have similarly simplified my ideas for the mechanism that is to occupy it.

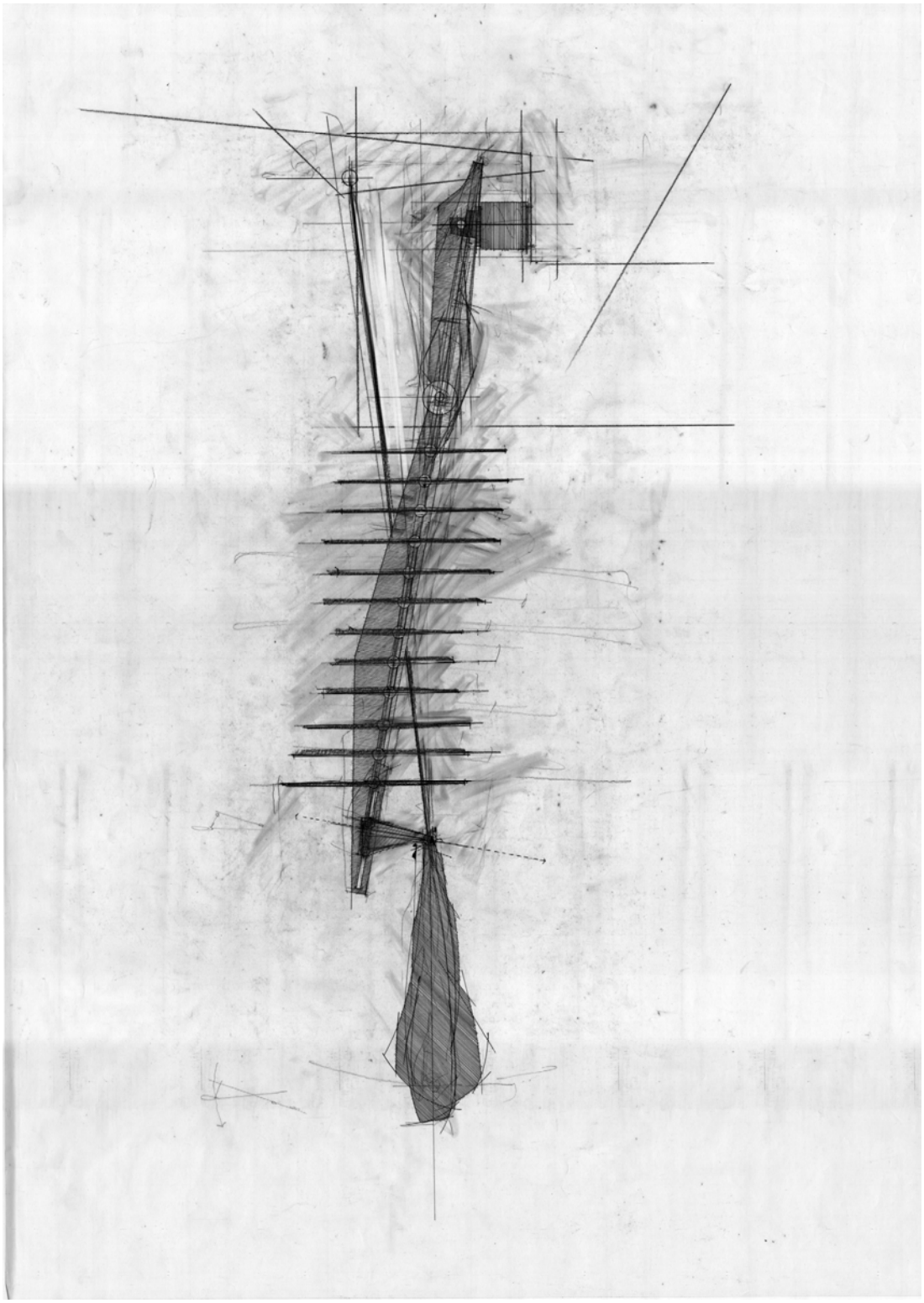

Figure 83: First iteration, study for mechanism (2).

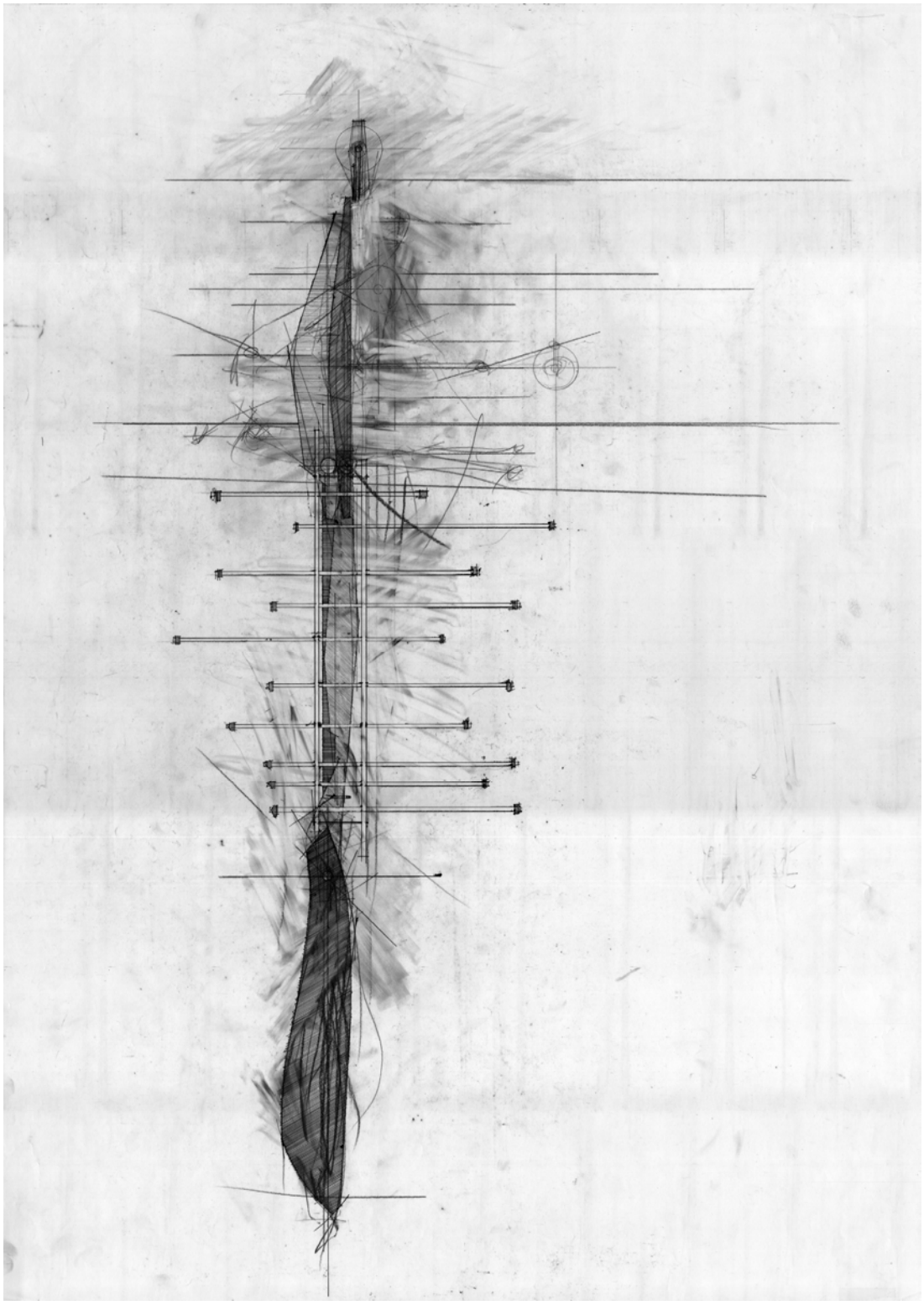

Figure 84: First iteration, study for mechanism (3).

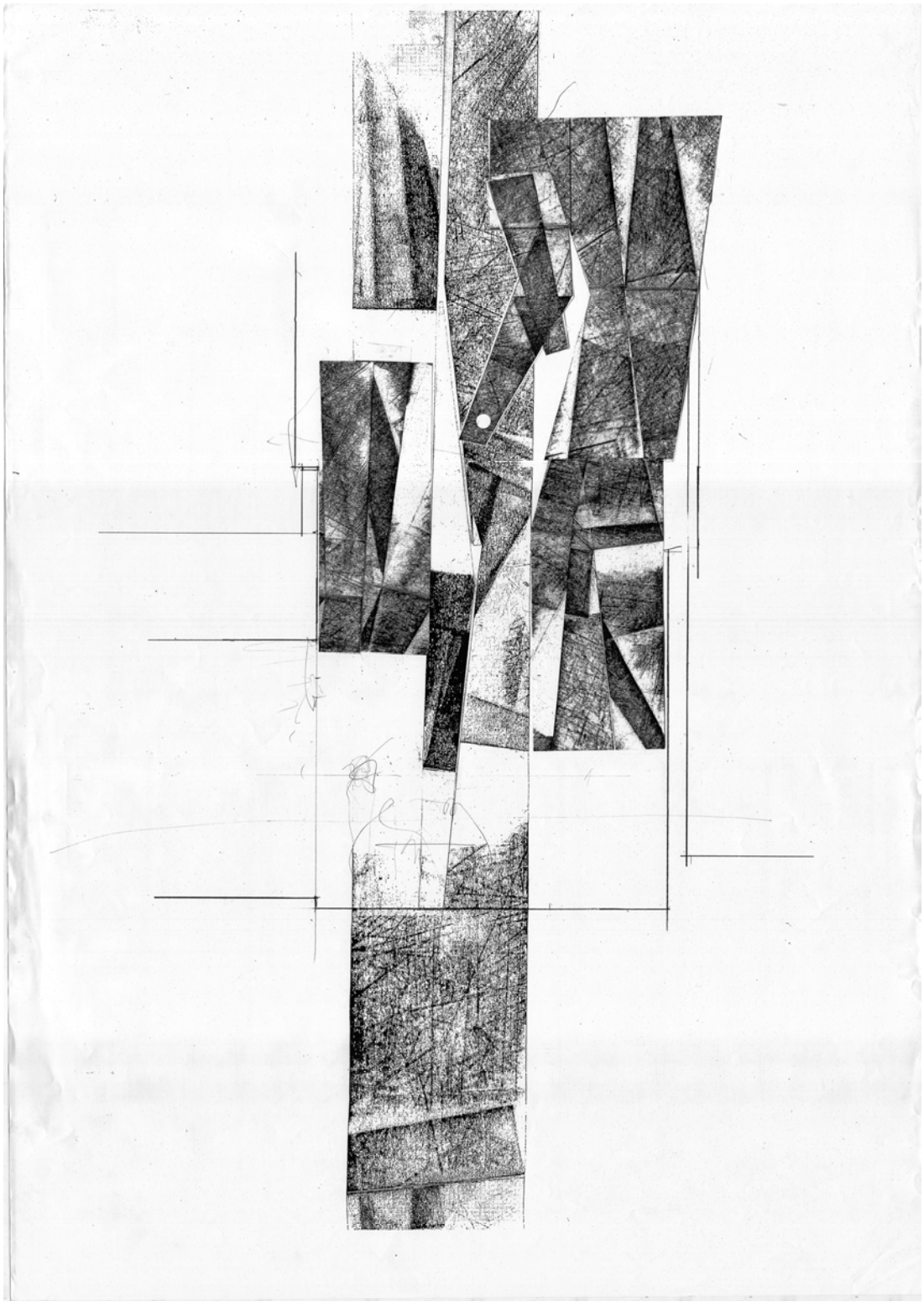

Figure 85: Collage study, section.

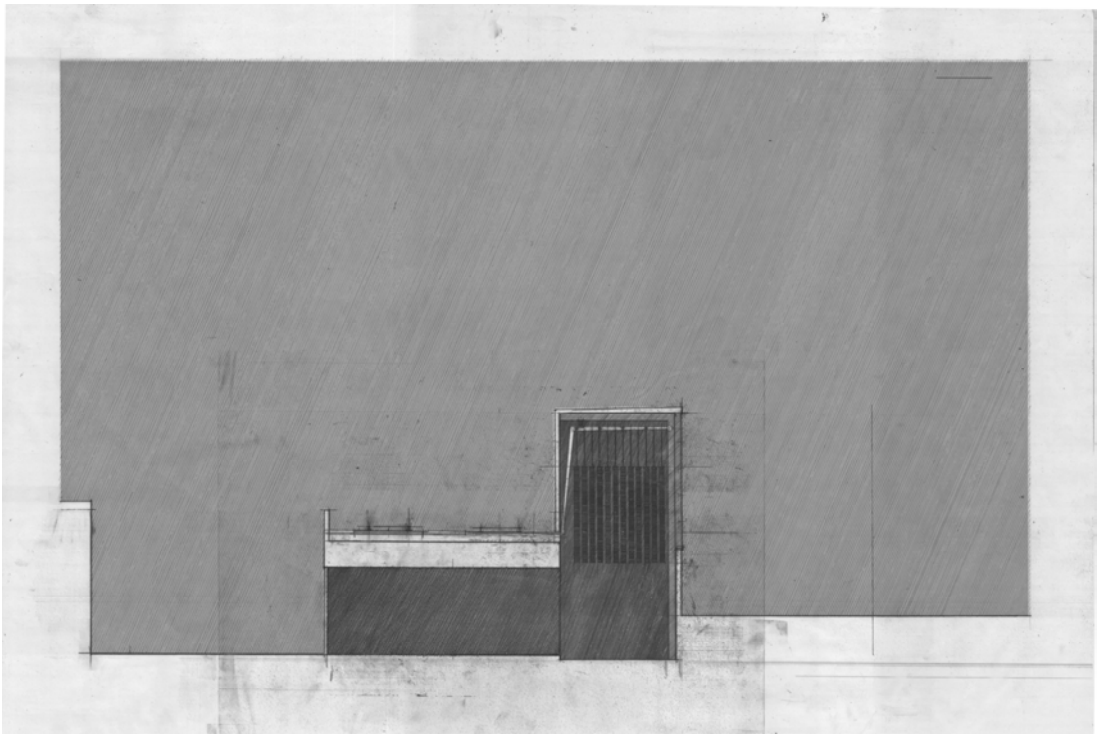

Figure 86: Second iteration, section, looking east.

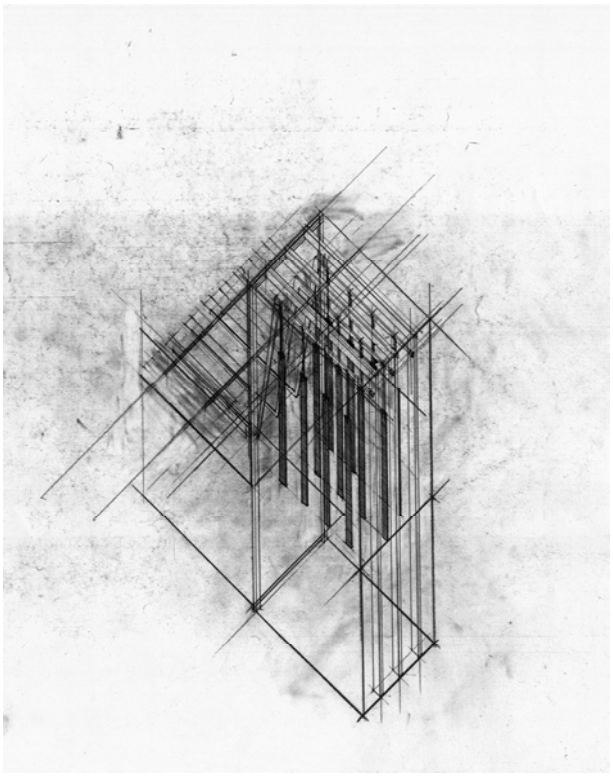

Figure 87: Cafe Bohemia, second iteration, axonometric showing hanging columns.

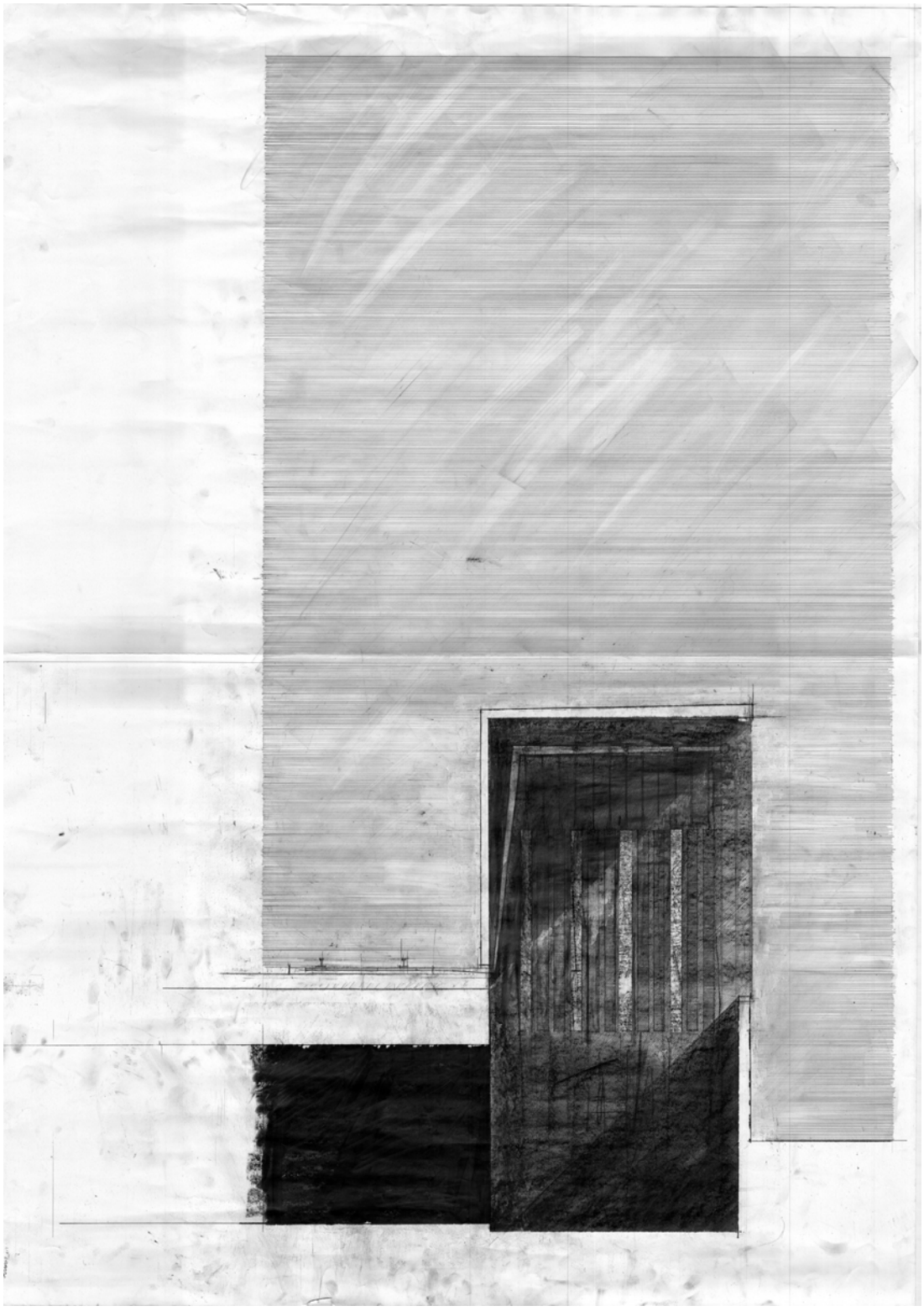

Figure 88: Cafe Bohemia, second iteration, proposed section, looking east.

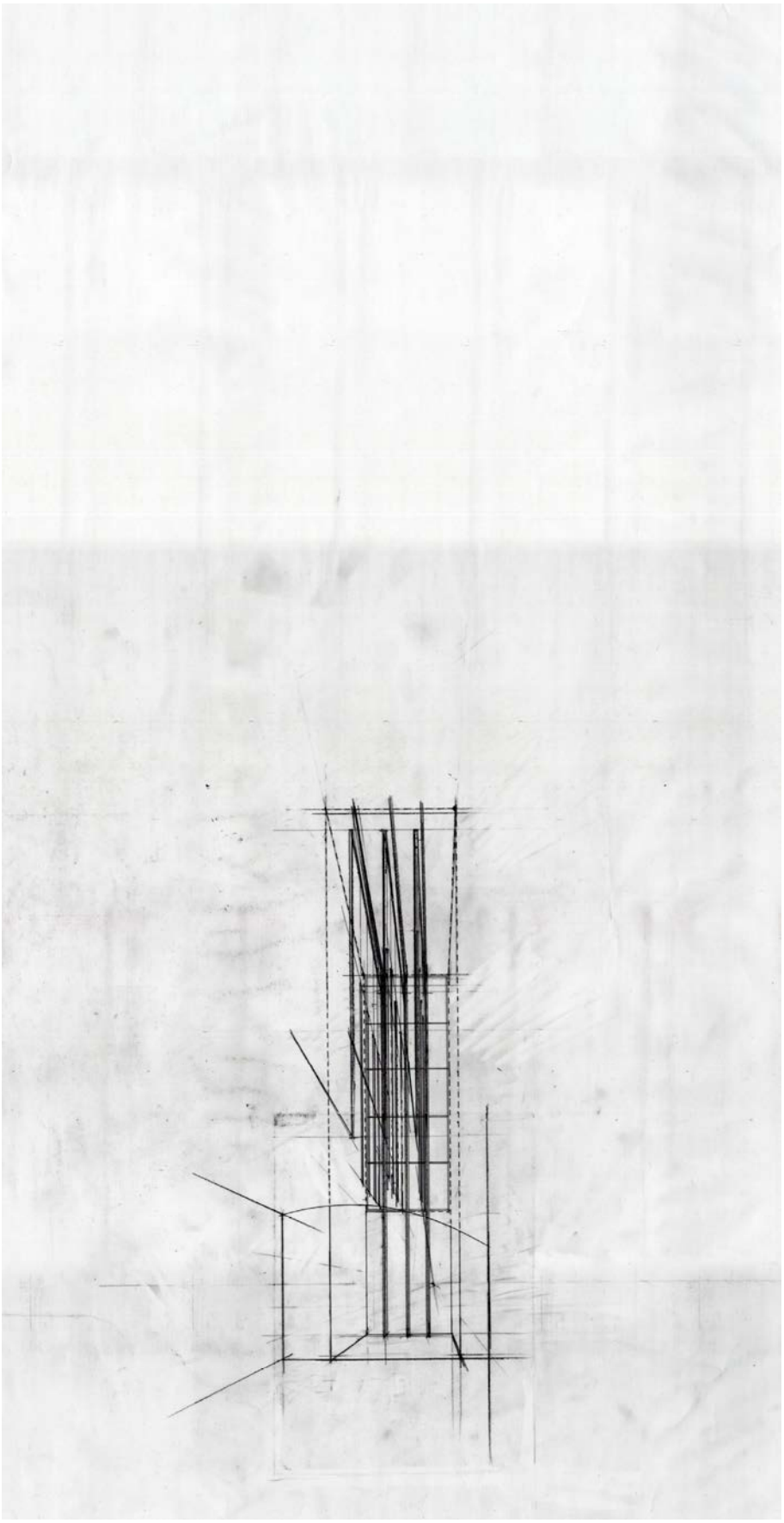

Figure 89: Perspective view from doorway.
Cutaway view through soffit of viaduct to proposed tower at rear area with mechanism.

3.2.3 Hackney Churchyard

St. John's Churchyard in Hackney is a collection of linked open spaces close to Narrow Way, Hackney's main shopping street (Figure 72). The graveyard has long been cleared and the area is currently managed as a park (Figure 90-Figure 97). It is divided into distinct northern and southern parts by the late C18th parish church of St. John-at-Hackney. The church's main entrance is, unusually, on its north side and faces towards Lower Clapton Road and Clapton Square. To the south of the church lies a walled garden, recently redeveloped as a children's playground. South of this, the churchyard extends westwards to the site of the original medieval parish church of St Augustine, of which all that remains is its tower, and leads onto Narrow Way, near to Hackney Central station. The connection between the northern and southern parts of the churchyard is via one of two paths which pass either side of the church and walled garden. The western path, a relatively narrow passageway, is much the busier, as it is the more direct route between Lower Clapton road and Hackney Central station. I would walk down this passageway almost daily, walking between my house and the station (and indeed to the café where the previous project was set).

The walled garden is most open to its south side, where the wall has several openings, while a fenced off row of elegant tombs surrounds the walls on the other sides. The main entrance to the walled garden is the south gate, opening onto the east-west path through the churchyard from Narrow Way to Sutton Place. There are three other gates. Two of these face roughly north and open onto the driveway that passes behind the church. The third, which I have never found unlocked, is located half way along the western side of the walled garden and opens onto the north-south passageway. Opposite the west gate, the passageway widens out to a small and non-descript area of grass around which is an untidy collection of cleared gravestones. Whereas in the rest of the churchyard, the similarly cleared headstones are beautifully set out, these give the impression of having been abandoned in this quiet corner.

The east-west axis through the west gate, passing between the walled garden, the passageway and the cleared graves, is not particularly noticeable. The gate is always locked and the wall and trees obscure the visual connection between the two. By moving between both spaces (and

by drawing the east-west section through the gate) one can imagine this axis between playground and gravestones and the narratives about the passing of time that can be constructed across it (Figure 95). This reading is heightened by the axis passing through the west gate of the walled garden—the sun's path moving from the life of the playground in the east to the graves in the west and setting over the gate at the end of the day, as viewed from the playground.[201]

In making a proposal for this site, my aim has been to articulate this symbolic reading while still maintaining the separation between the two worlds that is crucial to the walled garden's character as a playground (too direct a relationship with the surrounding gravestones would, I think, make the space too intense to be used as a playground). What I propose is therefore to emphasise the space of the gate and the direction of the axis through it without opening it up as something that is to be walked through. My proposal therefore leaves the axis as something that has to be imagined, similarly to how I have explored it, by experiencing each side of the wall separately. The purpose of my proposal is therefore to encourage the construction of this understanding by making the adjacencies across the wall more easily noticeable from the spaces on each side.

In order to do this I propose making a new gatehouse for the west gate (Figure 98-Figure 108), making a more formal entrance and exit to the walled garden at this point. However, I still intend that the gate remains largely shut and unused as at present and the project is therefore a gatehouse for a locked gate. This gatehouse sits astride the wall, partly within the garden and partly in line with the fenced off row of tombs on the outside of the wall. It is raised up above these and the wall on a series of columns. Above head height it has some enclosure to the north, south and east sides but is open to its west side and to the canopy of the trees above. The massing of the gatehouse above the wall emphasises the gate as viewed from the playground (Figure 106), drawing our attention towards it and so towards the direction of the setting sun.

---

[201] Such a reading of the space follows from what Harries (1997) has referred to as "the natural symbolism of light" (p. 178). Such a symbolism of space in relation to the rising and setting of the sun is a common feature of ecclesiastical architecture in particular and indeed the nearby church of St. John, though unusually entered from the north, is still set out on an east-west axis internally (meaning one enters awkwardly half way along its axis).

While the presence of the gatehouse is sufficient to emphasise the axis from within the walled garden, this is not enough to do so from the passageway. Passers-by walk past the view through the gate very quickly because their path is perpendicular to it. I therefore propose emphasising the direction of the axis crossing the passageway in such a way that would draw one's attention to it as one walks towards it (Figure 100, Figure 101, Figure 105). My idea for this is to create a track at high level with elements moving in a loop along the axis from gatehouse to the abandoned gravestones and back. The moving elements would be a series of 2m high weights which would hang from the track. These would be grouped in the gatehouse and would move out one-by-one triggered by the movement of people on the north-south passageway. One weight would begin to move for each person entering the narrowest section of passageway and would stop again when they reach the gate. The furthest advanced weight always moves first, the second only when a second person enters and so on. The movements of the weights, crossing the path of passers-by and being triggered by their arrival, would, I hope, encourage them to notice the east-west axis through the closed gate and to imagine themselves within it and so within the narrative about time that it suggests.

Figure 90: View of passageway at west of walled garden, looking south.

Figure 91: View of passageway at west of walled garden, looking south.
The locked west gate to the walled garden is to the left.

Figure 92: Area of poorly maintained cleared gravestones.

Figure 93: View from main path towards cleared gravestones.
The locked west gate to the walled garden is behind the small building on the right of the picture.

Figure 94: View of path to south of walled garden, looking east towards Sutton Place.

Figure 95: Photographic section through west gate of walled garden, looking north.

Figure 96: View from area of cleared gravestones, looking east, towards west gate of walled garden.

Figure 97: View from walled garden, looking west, towards locked west gate.

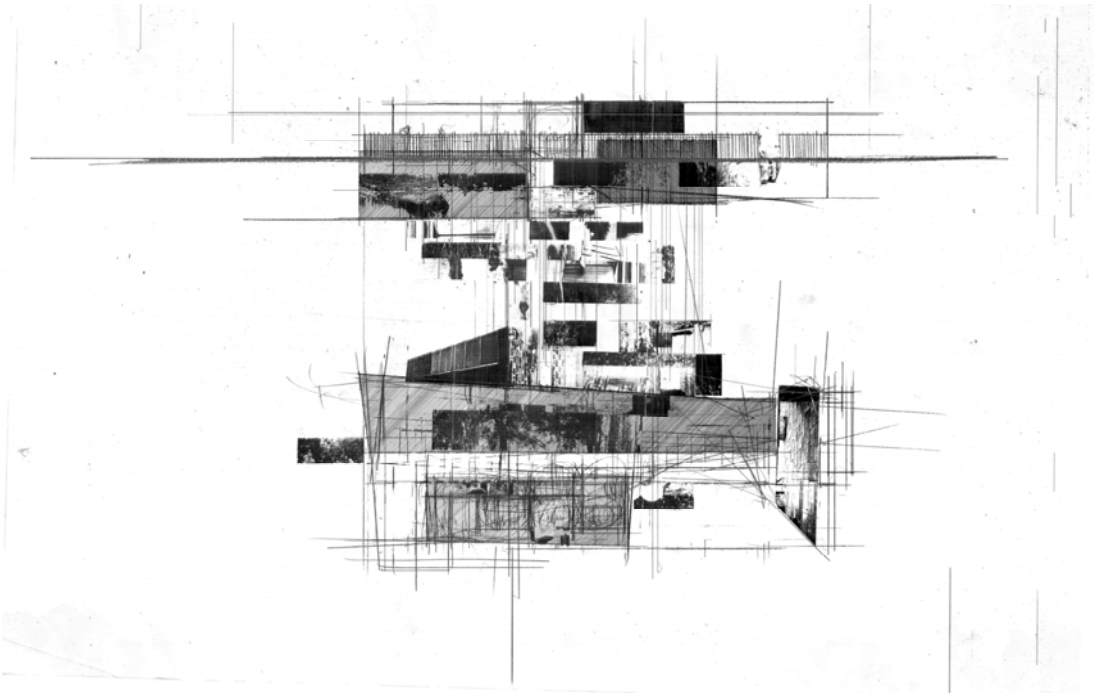

Figure 98: Composition study (1).

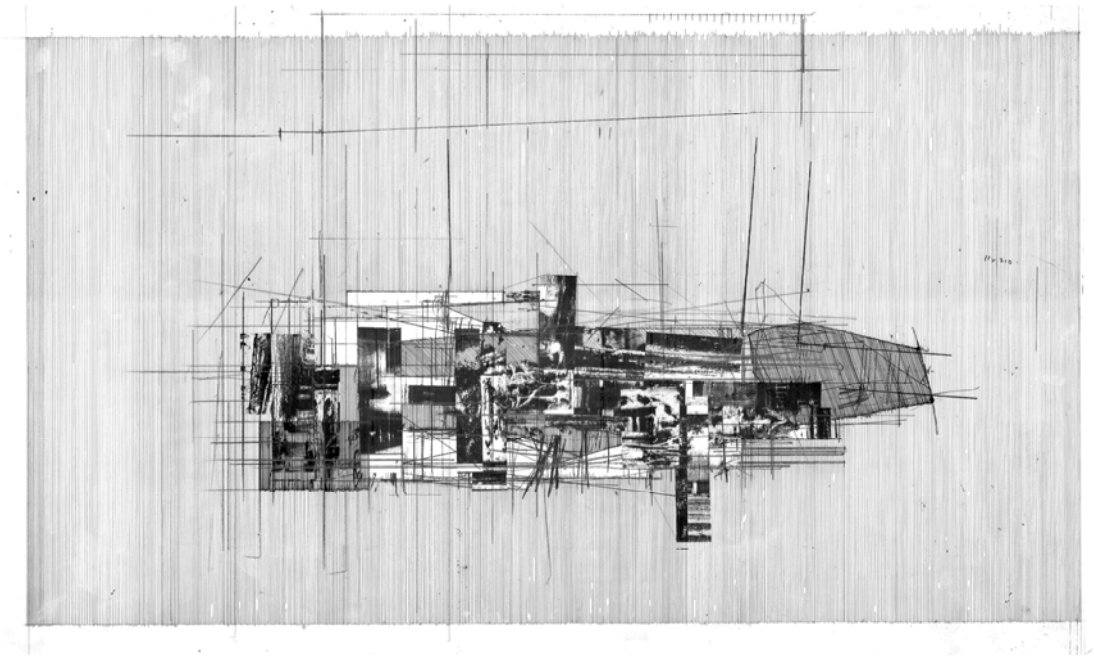

Figure 99: Composition study (2).
These drawings are two of a series of ambiguous studies I made in response to the site before coming up with ideas for the scheme. I have combined photographs of the churchyard (mostly gravestones and the tree canopy) using photocopying, which has made the images less figurative. I have then worked into the resulting copy with line work. They are not clearly propositional but it was from these studies that the ideas of intermingling architectural elements with the site and of placing something above head height, in the tree canopy, emerged.

Figure 100: Collage study for new canopy device (1).
Looking south along passageway, walled garden to the left.

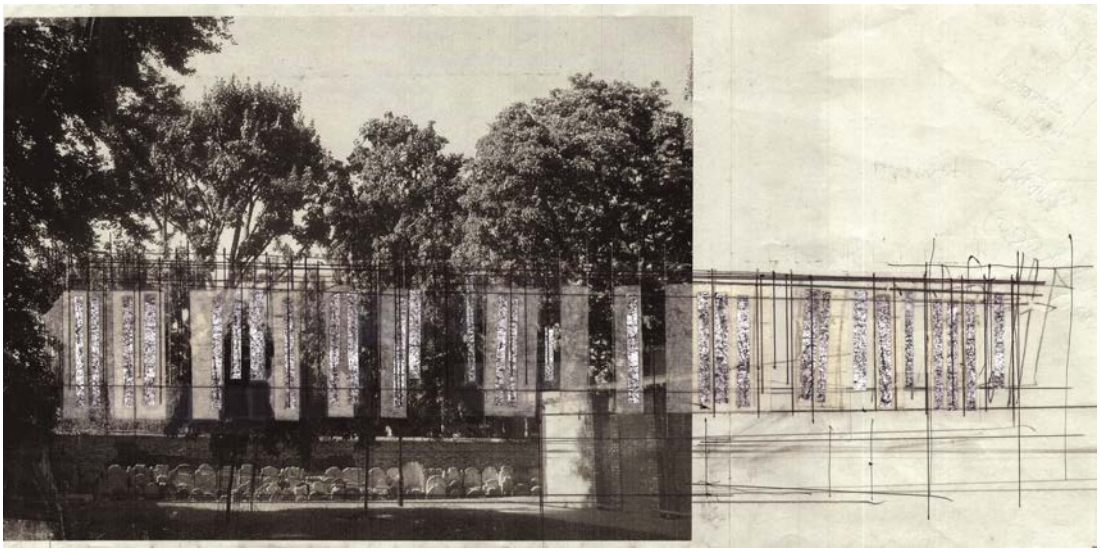

Figure 101: Collage study for new canopy device (2).
Looking north towards area of abandoned gravestones. The hanging vertical elements, which were characteristic of the Café Bohemia project, are again featured.

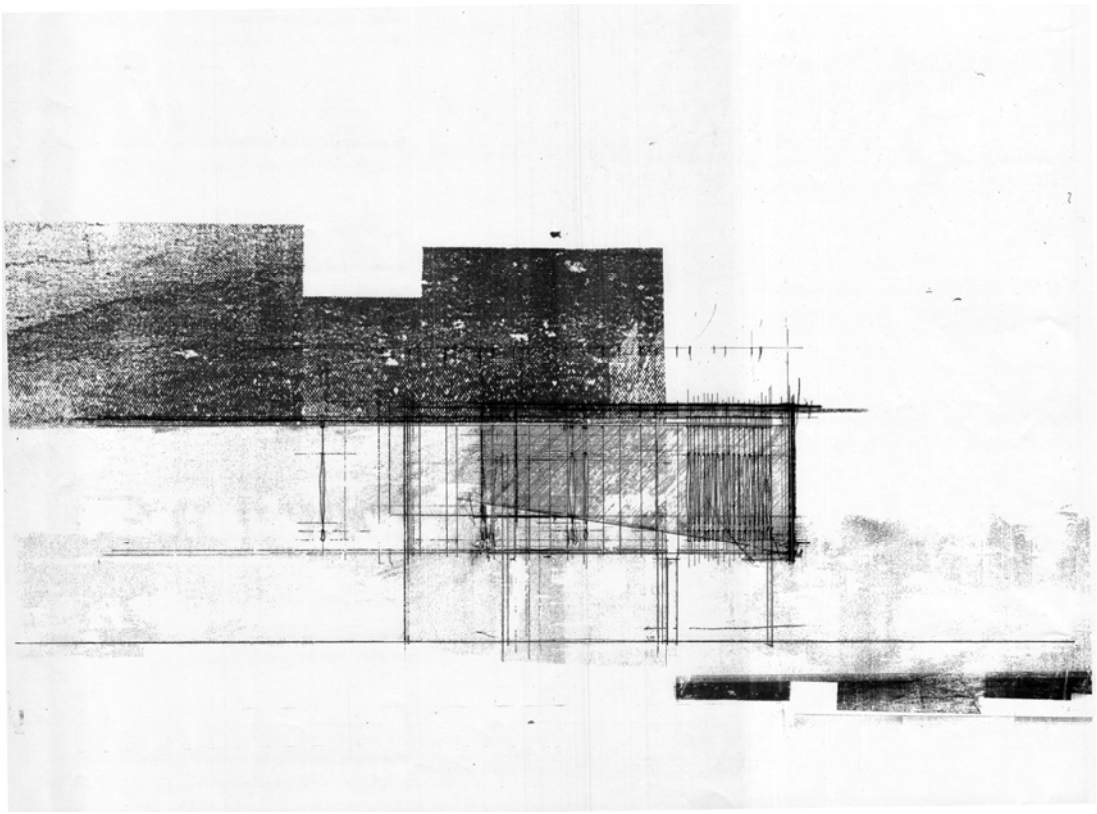

Figure 102: Sketch section for new gatehouse, looking north.
Walled garden to right, gravestones to left.[202]

[202] In these drawings the texture of the site, applied through collage and photocopying, is an important feature. In this drawing I have used it to indicate the tree canopy over the passageway side of the wall and, by contrast, the way that the walled garden is open to the sky.

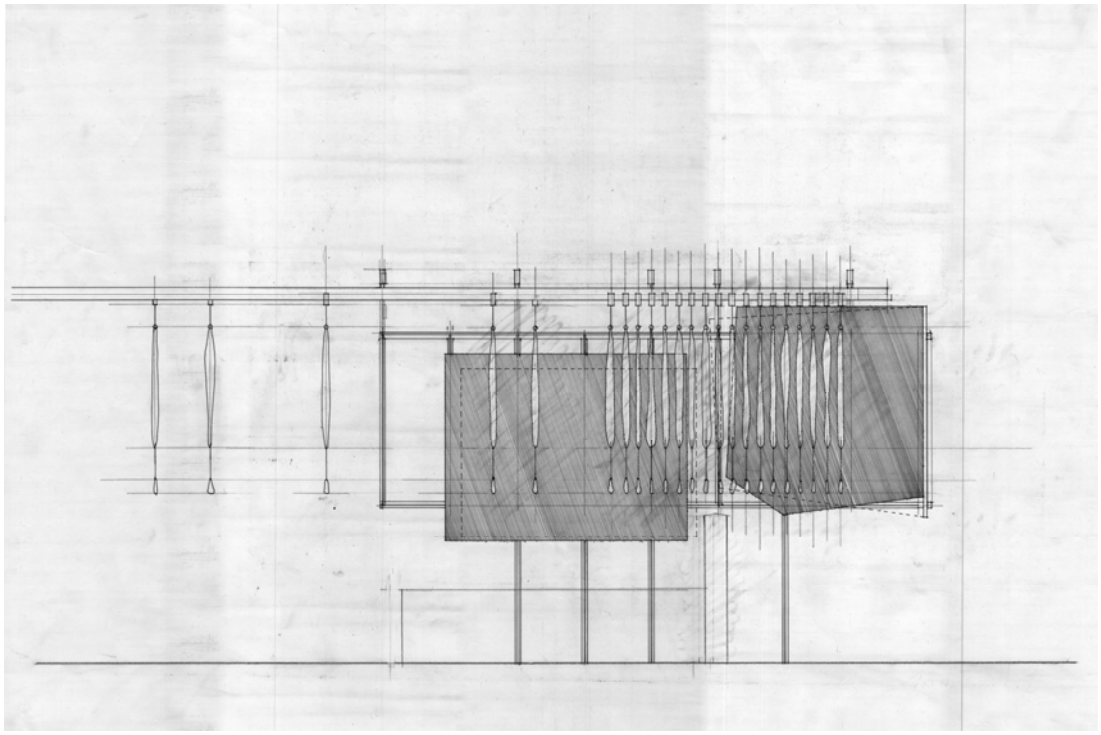

Figure 103: Section through proposed gatehouse, looking north.
In this, the final version of the design, the gatehouse structure straddles the wall and its enclosure is more fragmented allowing the tree canopy to intermingle with it. This picks up on some the features of the first ambiguous studies which I have read as intermingling contrasting elements of figure and ground, proposal and site.

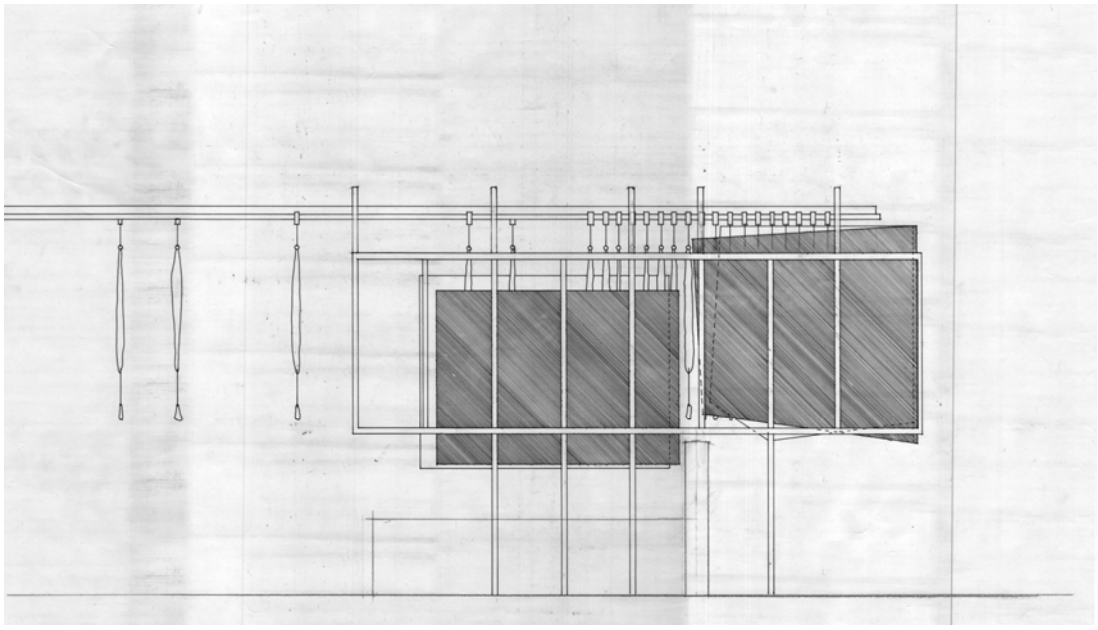

Figure 104: Proposed gatehouse, south elevation.

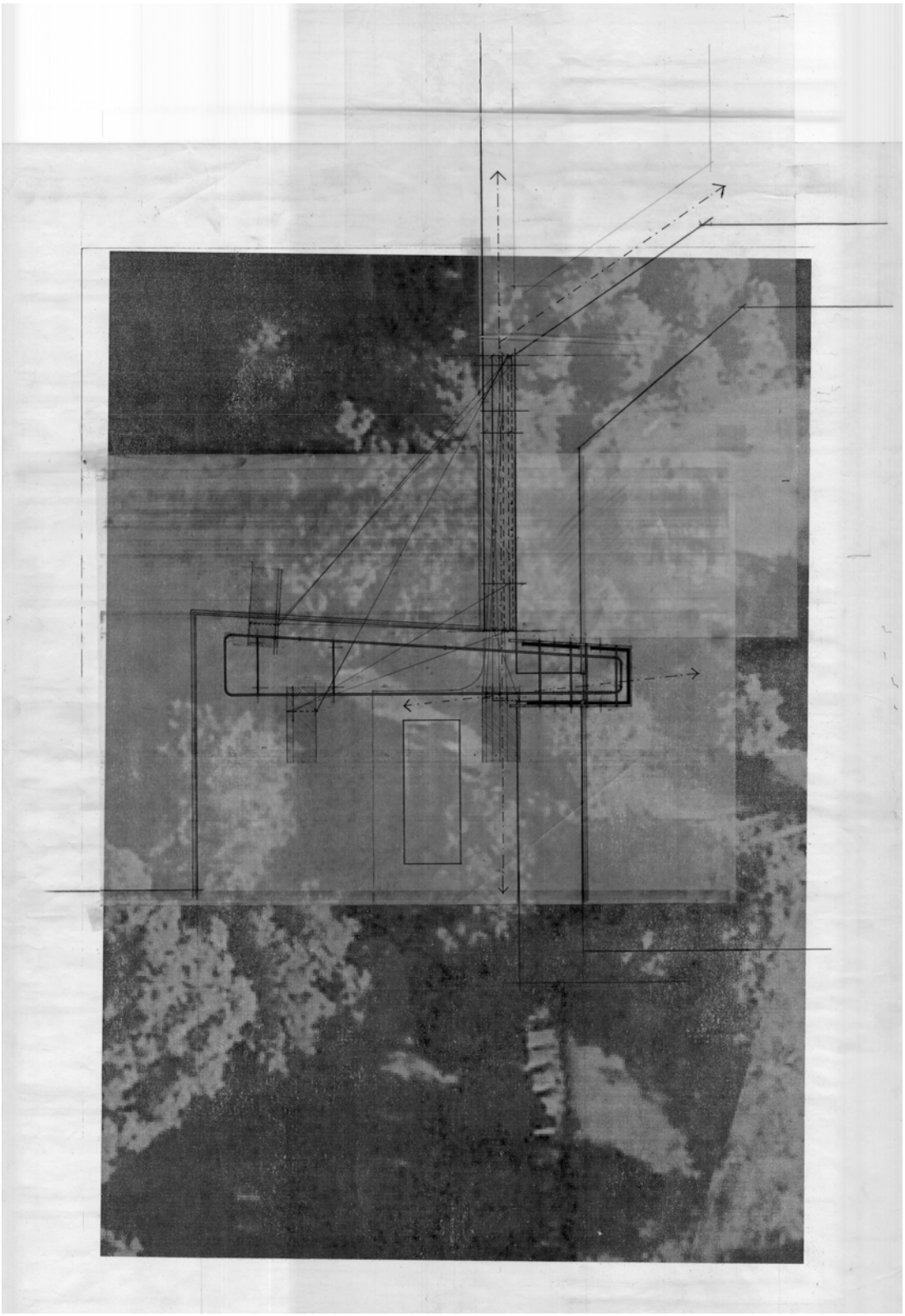

Figure 105: Plan of gatehouse and track.
North is up the page, the walled garden is to the right. The track extends from the gatehouse and over the north-south passageway to the area of cleared gravestones and returns.

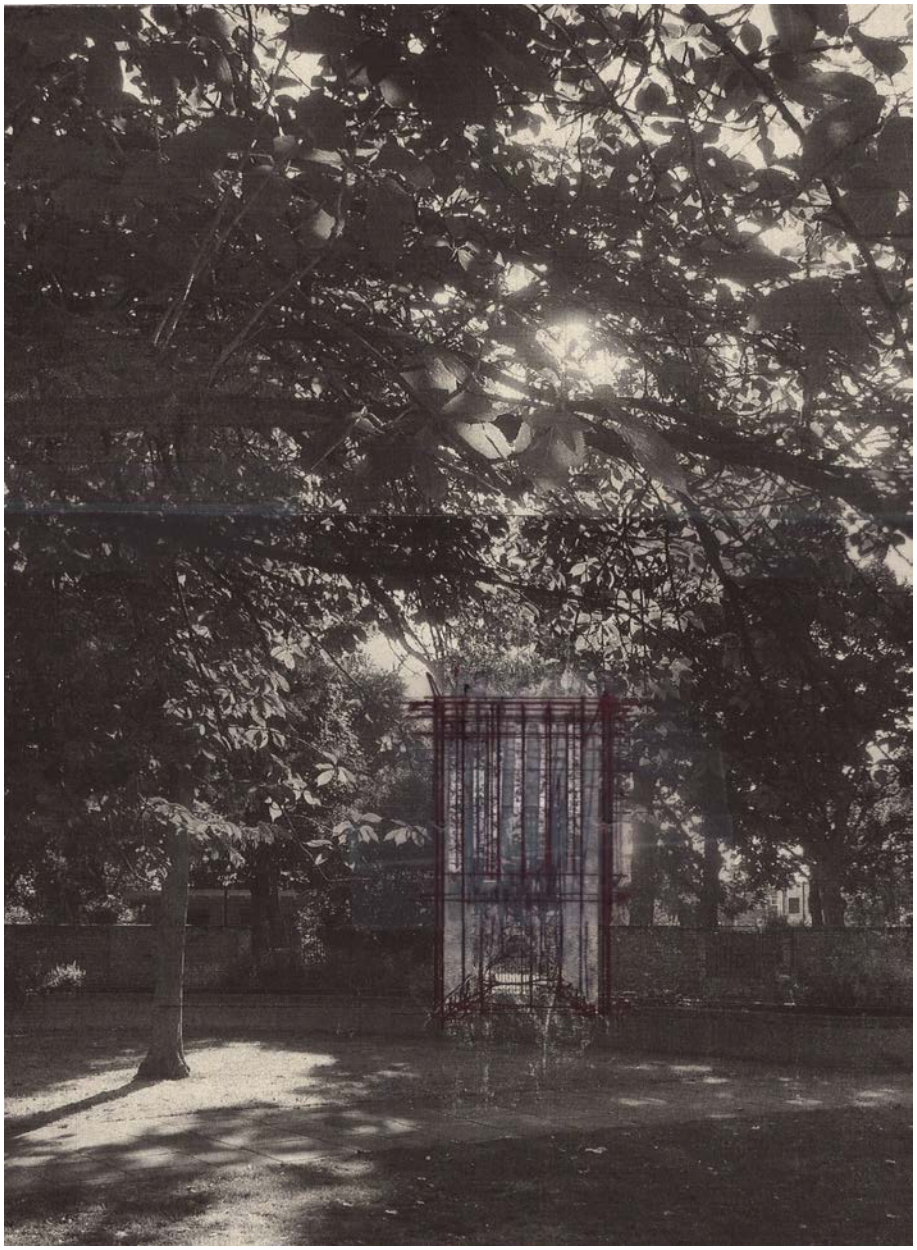

Figure 106: Study of gatehouse from walled garden.

Figure 107: Proposed gatehouse, south elevation.
The walled garden is to the right and the gravestones are to the left. The gatehouse sits astride the wall and so on the edge of the tree canopy.

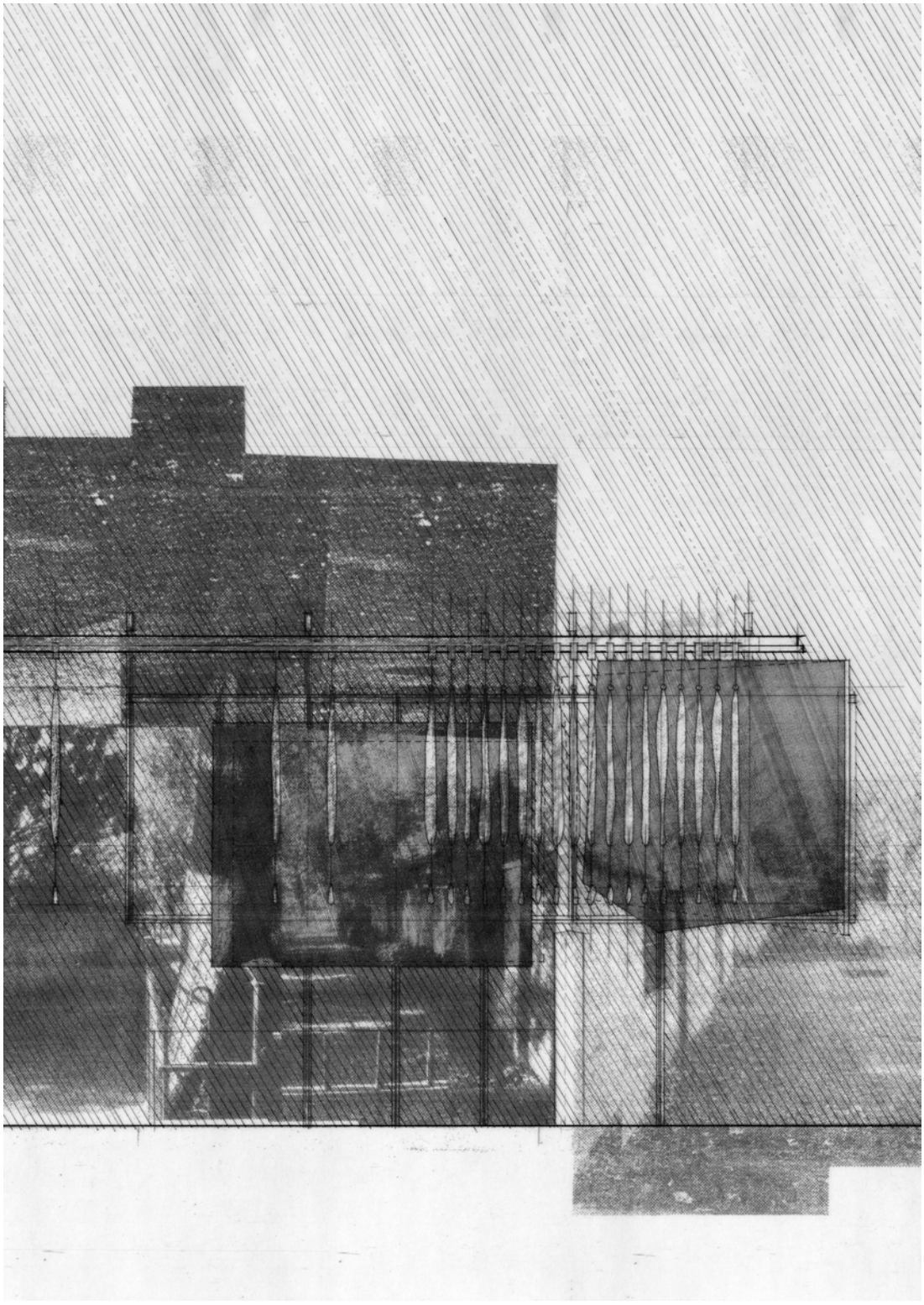

Figure 108: Section through proposed gatehouse looking north.

3.2.4 Summary: Lingering realism

While there are many aspects of these two projects which I enjoy, I have some reservations over the approach I have taken in designing them. The idea of articulating and emphasising one particular understanding of a place, at the expense of other possibilities, seems overly didactic and illustrative in such a way as potentially to imply that this is the one correct interpretation. It is not that these projects are in themselves particularly deterministic or problematic but, within my own work, the definiteness of my intentions in them contrasts with aspects of the epistemological and ethical position I have set out from. While there is always ambiguity to how architecture is interpreted, the strategy I have followed has sought to minimise this. The architecture that I have proposed is intended to replace my verbal or textual narrative, leading an observer through the construction of this particular interpretation. This has the advantage of an understanding being more easily associated with a place, and so more easily shared with others, but it also excludes other interpretations and so reduces the potential range of meaningfulness of the place.

By contrast, one of the interesting aspects of the proposals I made for St. Alphage Gardens is the way they retain an ambiguity in how they can be interpreted. This follows in part from the less pre-determined approach I have taken in designing them—transplanting ideas from the index projects to a very different site was in itself a speculative move and the projects were then developed quickly through drawing. Following from this looseness of process, there is a similar openness in how the proposals can be understood. The Café Bohemia and Hackney Churchyard projects by contrast were conceived and undertaken in a very deliberate and linear manner. I began with my strategy already decided—to find a place where I could construct an interpretation of the site as expressing our being part of the world and to design an architectural intervention which would make this reading of that place a more viable construction. In contrast to St. Alphage Gardens, both Café Bohemia and Hackney Churchyard are comparatively univocal rather than capable of sustaining multiple interpretations and emphasise qualities already present in the site rather than transforming or adding to it. Similarly, whereas St. Alphage Gardens led to different lines of enquiry, neither Café Bohemia nor Hackney Churchyard have opened up new ways forward in my work.

The definiteness of both the Café Bohemia and Hackney Churchyard projects is, though, not solely a function of my own pre-defined strategy in developing them but also follows from the nature of what each attempts to communicate. In both projects I have tried to juxtapose everyday situations with aspects of our spatial experience that I have taken as being common to us all (the verticality and horizontality of the space that we are embodied within; the east-west movement of the sun, with its association with time). In one sense to emphasise common aspects of our experience in this way is to criticise the exclusion of experience in objectivity (for instance Norberg-Schulz, 1971, pp. 12-16; Vesely, 1985, p. 26; 2004, p. 249) and so to refer to the world of our experience rather than our experience of the world.[203] However, there is an implicit tendency towards realism in speaking of those aspects of experience which are common to us all. In doing so, one refers to what underlies our experience and so to the real world (that is, the world beyond our experience) of which constructivism insists on remaining agnostic.

There is therefore an uneasy relation between these spatial qualities and the idea we are part of the world. While they emphasise our embodiment as part of the world, to present them as being universal to experience is to make a claim in the mode of being apart from, rather than part of, the world. In one sense this can be resolved by careful choice of terminology, such as noting: (1) that what is referred to is our experience rather than the world beyond it; (2) that where one proposes an aspect of spatial experience as being common, this is to construct one's own understanding rather than to describe a fact; and (3) that patterns of spatial reference across a culture have been formed by the sort of interaction which von Foerster (1991, pp. 72-73; 1976/2003) described in terms of eigen-behaviours. Yet whereas it is possible to make such distinctions in language, the medium of architecture cannot clarify itself with such precision.

Where we try to communicate an idea through architecture we do so in a way that builds it into our experience of the world, giving it material presence and effectively forming the world in

---

[203] While Vesely (2004) notes that this latent world is the "the primary source and measure of objectivity" (p. 379), this is in itself a criticism of objectivity, placing it within the realm of our spatial experience, rather than a claim to objectivity on behalf of his account of the latent world.

accordance with it. This can lead to a paradox in the case of trying to communicate our being part of the world architecturally. Even if we do not intend to communicate an idea as being objective in status, to communicate it in architecture is often to present it as if it is so because of the predominantly one way nature and actuality of architectural communication. Thus, even though the Café Bohemia and Hackney Churchyard projects communicate ideas which express our being part of the world, in emphasising this one interpretation they contradict their own message. In proposing these projects I therefore run into a similar presentational bind as that of a radically constructivist or second-order cybernetic approach elsewhere. A radically constructivist epistemology cannot present itself as being a true account of epistemology without contradicting itself and similarly any explicit account of the ethical aspects of second-order cybernetics risks collapsing them into moralisation. In the same way, where we communicate our being part of the world in architecture we risk implicitly presenting this as if it is objectively the case and, in so doing, potentially contradict the epistemological aspect of this idea.

PART IV—Intersections, conclusions, new beginnings

Introduction to Part IV

So far, in Parts II and III, I have investigated two aspects of the idea that we are part of the world in relation to architecture: firstly, in terms of the epistemological and ethical sense of this idea as manifest in the design process; secondly, in terms of its spatial sense and my proposing architectural projects which attempt to heighten this. These two lines of inquiry connect to each other both in the interrelation of the different senses of our being part of the world with which they began (this being both a spatial idea with epistemological consequences and an epistemological idea with spatial consequences) and also in the way my own design practice is one example of the more general account of the epistemology of designing. I have, however, so far kept these two strands more or less distinct from each other and each has led to its own conclusions. In Part II, by drawing on the connections of cybernetics with design and with ethics, I argued that ethical questions are implicit in the epistemology of designing and suggested ways in which this is relevant to more general ethical debates concerning ethical dilemmas, inter-personal relationships and questions about purpose. In Part III, through my various design projects, I have explored ways in which architecture can draw our attention to our presence in a place and, in doing so, heighten our experience of being part of the world. In this, these projects have raised epistemological and ethical questions in relation to those of Part II. In particular, despite following strategies that I had thought would express our being part of the world, I have found it difficult to escape implying realism or at least the appearance of realism (for instance: the correspondences and apparent completeness of the Allotment Calendar; the emphasis on particular qualities of spatial experience in Café Bohemia and Hackney Churchyard) with the various ethical connotations this brings with it (right answers and so moralisation). As well as the qualities of these projects, the conclusion of Part III has therefore been the identification of where realism has persisted in the strategies I have followed and in the appearance of the architecture I have proposed.

One of the questions that is raised by the way I have explored different aspects of the idea that we are part of the world in initially separate investigations is how these relate to each other beyond the idea that they share. I have avoided presenting either as following from or as justifying the other in a linear way and have instead allowed these investigations to develop mostly independently. Below I draw these two strands together by examining some of the points at which they intersect with each other (in section 4.1). In doing so, I repeat some of the points already made above but bring them to a conclusion. This returns to the idea of our being part of the world (with the three senses I distinguished above: epistemological, ethical, spatial) with which I began in order to extend or revise aspects of my understanding of this starting point, given my subsequent investigations, and in so doing to form a joint conclusion to the two parallel strands of my work.

The first of these three intersections is that between the epistemology of designing architecture (which I have described in Part II and practiced in Part III) and the epistemology of experiencing it (which is a feature of Part III, especially where I have been concerned with the communicative qualities of my proposals). The second intersection is between the epistemological (Part II) and spatial (Part III) senses in which we are part of the world. I have used this, below, as a starting point to revise the assumptions I made at the outset about the spatial and architectural senses of being part of the world and to differentiate an approach that is distinctively cybernetic in its conception of space, as well as its epistemology, from the phenomenological sources that I referred to above. The third intersection is that of the parallel between architecture and ethics and, specifically, between what I have above called the ethical question of ethics (that is, the ethical consideration of our conduct in deliberating over ethical questions) and the ethics of architecture.

While I have presented these three ideas separately below, I have also proposed a way in which they can be explored together in a renewed design investigation (section 4.2). In this way I have suggested how this conclusion can be thought of as a new beginning, effectively updating the design questions with which I began above given what I have learnt through my explorations so far. I have presented my attempts to begin this and so the design questions that I will take forward from this thesis to continue working on (remembering, from my discussion of wicked problems, that with design questions one expects any solution to redefine rather than solve the question at hand).

Lastly, in section 4.3, I have drawn the fourth and final part of this thesis to a close by reflecting back on the points I have made and the significance of these within the different contexts with which I have been concerned.

4.1 Looking back: Intersections

4.1.1 The epistemology of designing and observing architecture: Conversing with drawings and buildings

The first of the three intersections between Parts II and III that I have identified is that between the epistemology of designing architecture and that of observing or interpreting it, both of which can be understood in terms of conversation. While it is common to understand the epistemology of design as a conversation (or in similar terms), it is more usual to discuss architecture's communicative qualities in terms of coding of some kind, such as the symbol systems established by tradition or those described by phenomenology, structuralism or semiotics. To understand our experience of architecture in terms of coding is to understand meaning to be a property of the architecture, of space or of culture rather than something to be constructed by its observers. Given that architecture, generally speaking, remains static and unchanging, that we tend to think of it in terms of code rather than conversation is not surprising. However, considering our experience of a building as unfolding over time, it is also possible to understand it in terms of a conversation one has with oneself (similarly to that which designers have via drawing) such as, for instance, Pask's (1969, p. 495) account of Gaudi's Parc Güell (see also Gage, 2006; Harries, 1997, pp. 216-220). Even in understanding architecture in terms of its various codes and conventions, such as in the account of Jencks (1977/1984), the changeability of such codes (e.g. p. 71) leads to a discussion of their formation and so rests on an essentially conversational process.

While they do not do so actively, there is still a sense in which buildings participate in our conversations with them. This is similar to the sort of conversations that designers have with themselves via drawing and to the general account of epistemology in terms of viability given above. In observing a building we construct an understanding of it that we then adapt in response to our continuing experience. Any understanding which we construct will be just one of many viable understandings both in the sense that we can understand a building in different ways and also in very different sorts of terms (for instance: how it was constructed; how it is organised; how we are to use it; its personal significance for us; what the designers were trying to do; how this building

relates to its physical, cultural and historical context and so on). As we continue to experience a building, whether by actively investigating it or just by continuing to use it, our experience of it changes and the question of which possible understandings of it are viable changes with this. New interpretations continually become available while some others, which were previously viable, become unsustainable and we think of new reasons for choosing one viable understanding over another.

There are various advantages to a conversational approach to explaining architectural communication over doing so in terms of code. These are both in terms of interpreting existing architecture and also in making propositions. These are similar to those of a conversational account of communication in other contexts. Firstly, conversation provides a more general account as one can understand coding as a special case of conversation (Glanville, 2004b, p. 1382). Secondly, it is inherently creative in contrast to the conservatism of codes where it is in principle only possible to communicate in terms of what is already communicated. Thirdly, it avoids the implication that there are true interpretations or real meanings in what is communicated. That we converse with buildings rather than decode them also explains the ambiguity of architecture as a communication medium. The conversation we hold with a building takes place between the observer and the building rather than with the designers who are absent. The building does not actively participate in the conversation and only limited feedback occurs. The building therefore has little influence on how it is understood as it cannot clarify itself or its designers' intentions in response to the questions asked of it, as is possible in an everyday human to human conversation. There follows an ambiguity that can be either seen as a difficulty to be overcome or, alternatively, as leading to a variety of interpretations, creating a more stimulating environment. Indeed part of architecture's communicative power is its very lack of representational accuracy and its resulting openness to interpretation—if one wanted to just convey a specific point one could choose a different, more articulated, medium, such as a text (see also Vesely, 2004, pp. 42-107).

While so far I have emphasised the gap between designers and those that observe what they design, that the analogy with conversation can be used both of designing and observing architecture suggests ways in which this gap can be bridged. Above I have discussed how drawings

and models allow designers to see through the eyes of those they design for and so are not just practical and epistemological but are also ethical and participatory (section 2.1.3). The significance of drawings and models in making this possible is not just that they simulate a proposal but that they do so in a way that presents this simulation in comparable terms to what it simulates, such that the activity of drawing or modelling is epistemologically comparable to observing a building. While it is common to think of drawings and models as forms of abstraction, what gives them their significance in this sense is that they combine actual and abstract characteristics.[204] The more abstracted forms of representation which designers use, such as textual descriptions (e.g. a specification) or numerical codes (e.g. a colour code), are more precise than drawings and models in communicating specific information (for instance for cost estimates or during construction) but are of little use when it comes to designing compared to their more ambiguous drawn equivalents.[205] In designing, drawings and models are not about transferring information. Their significance is that they share actual qualities, such as space and texture, with what they propose while being abstracted enough from these qualities to make them easily manipulable by, for instance, including only those dimensions and levels of detail that are relevant to the task at hand. For instance, I can "walk through" a plan drawing in a similar way to how I walk through the spaces it proposes by moving (my gaze) through the space of the drawing. By contrast, a diagrammatic or textual description, though it can convey the same information, is only experienceable as information rather than in terms of space.[206] In terms of my work, my drawings have worked in such a way in their

---

[204] I first developed this argument in my paper for the Cybernetics: Art, Design, Mathematics conference of the American Society for Cybernetics, Rensselaer Polytechnic Institute, Troy, NY, 2010 (Sweeting, 2011a).

[205] The counterpart to my argument about the importance of ambiguity of drawing in designing is the necessity of removing this ambiguity in construction information. See for instance Amhoff's (2011, 2012) research on the origins of building specifications.

[206] While the contemporary ubiquity of computer modelling software creates new possibilities for drawing, it is in this sense a less sophisticated form of drawing than conventional plan and section projections because, being less abstracted, one must include much more information in order to manipulate one particular aspect. This is especially noticeable in undergraduate students who are often bewitched by the views of their computer model without questioning those aspects, such as circulation, proportion and materiality, which are revealed more easily through other ways of drawing.

general concern with mark making and repetition which relate to some of the architectural qualities with which I have been concerned.[207]

I do not, however, mean to efface the differences between drawings and buildings: the translations that occur between the two (Evans, 1986); the important qualities that drawings fail to capture (and that likewise buildings fail to capture from drawings); or the inaccessible language of architectural conventions to the uninitiated (Till, 2005, p. 37; 2009, pp. 109-113). Ignoring the differences between drawings and buildings can lead to a gap opening up between the two such that, for instance, a building "looks good on plan" or in the published photographs without this quality being present in our experience. My argument is not that the artefact of the drawing corresponds to what it proposes but that there is a similarity between our epistemology in the activity of making a drawing and that of understanding a building. This is not just because the drawing and the building are alike in terms of their properties—that, for instance, the dimension of one corresponds via scale to the dimension of the other—but that the epistemologies of understanding drawings and buildings are similarly spatial and conversational activities. This is not to say that these are identical processes but that there is a relation between the two such that when we construct an understanding from a drawing or model then there is a chance that we will be able to construct a similar understanding from the building it proposes. That is, the significance of drawings or models in design is not that they simulate what they propose but that they simulate the epistemological act of understanding it.

The significance of drawing and modelling for designers is therefore not just, as I've noted above, that new ideas are generated in the process but, more especially, that ideas developed in this way have been constructed similarly to how they might potentially be constructed about a building. In this way, in trying to create a design that can be understood in terms of some particular idea,

---

[207] More particular examples of this include: the contrast in the Contingency project between the precision of the line work and the arbitrariness of the geometries; the relation in the Allotment Calendar between the repetition of the drawing and the activity of the allotment; and where, in the St. Alphage Gardens project, I have introduced elements of collage in relation to the fragmentary nature of the site.

designers use drawings and models not just to develop a design in terms of that idea but also to test what an observer will be able to construct from what is proposed. In this, the ambiguity of drawings and models is not just a useful source of ideas but is appropriate to the ambiguity of interpreting the architecture that they propose (indeed this ambiguity is one of the things that are being modelled).

4.1.2 The epistemological space of being part of the world: Rethinking the architectural theme of place

The second of the three intersections between Parts II and III that I have identified is that between the epistemological and spatial aspects of our being part of the world, with which I began above and which I now revisit in the light of my subsequent design explorations. In introducing the spatial sense of our being part of the world, I referred to Heidegger's idea that our being is a being-in-the-world in the sense of being involved in it, which has been influential in architecture via writers such as Harries, Norberg-Schulz and Vesely and in architectural themes such as that of place and dwelling. Being-in-the-world is the central theme of *Being and Time* (1927/1962) and continues, with different terminology and emphasis, throughout Heidegger's later writing and especially in his discussions of dwelling and the related notion of "the fourfold" (Heidegger, 1951/1971, 1950/1971, 1951/1977). In this section I return to the connection I made at the outset above between the epistemological sense in which we are part of the world (in the sense of Bateson and von Foerster) and the spatial sense of our experience being embodied within the world. My reason for returning to this is in order to question this connection, not as being invalid, but on the grounds that in adopting it I ended up (especially in the Café Bohemia and Hackney Churchyard projects) implying realism and so doing the opposite of what I intended.

The approach I have taken in the design projects of Part III has, although differing in several respects, taken its point of departure from aspects which are of concern in a phenomenological approach to architecture, such as the typicality of everyday situations, our bodily presence and suggestions of the spatial conditions of the natural world which are common to us all. Especially in the case of my Hackney Churchyard and Café Bohemia projects, but to an extent also with the Allotment Calendar, what I have proposed has tended to imply some sense of correspondence and

so realism. With the Allotment Calendar this was partly because of the similarities between the translation mechanism it employed and a realist model of epistemology and partly because the way it made its presentation of these partial pieces of information implied that they formed a complete description. In the projects which followed the Allotment Calendar (Toast Rack, Stair Clock, St. Alphage Gardens) I adapted this strategy so that this implication of realism no longer occurred. In contrast, the realism implied by my proposals for Café Bohemia and Hackney Churchyard followed from the original ideas of the projects. While this is in part a quality of their univocal presentation (in attempting to communicate one particular interpretation, this interpretation, whatever it is, is presented with a sense of objectivity), it is also implicit already in my concern in these projects with common aspects of spatial experience. In this section I return to these ideas in a different way in order to distinguish a genuinely cybernetic account of the space of our being part of the world, understood as one that does not imply realism.[208] In order to do this I now turn to some aspects of Heidegger's later work that make a different sort of comparison between phenomenology and cybernetics possible.[209]

Heidegger's later philosophy is often thought of as difficult to interpret; yet, because it addresses content which relates directly to architecture, it is these works that are most accessible from an architectural point of view (as Sharr, 2007, p. 4 notes). The most directly applicable to architecture is "Building Dwelling Thinking" (Heidegger, 1951/1977), originally presented in the context of the post-war housing crisis but which begins by distinguishing the question of dwelling from the practical problem of housing. What Heidegger means by dwelling is closely linked to one of his most ambiguous concepts, that of the fourfold, or *das geviert*, comprising earth, sky, mortals and gods (1950/1971, pp. 174-180; 1951/1977, pp. 327-328).[210] As Harman (2002, p. 190), Mitchell

[208] By avoiding implying realism I mean the sort of realism that implies that our knowledge is a correspondence with the world and so objective, not the sort of realism that refers to the reality that we construct.

[209] I initially developed the argument of this section in an article for an edition of P.E.A.R. on the theme of dwelling (Sweeting, 2011c).

[210] I haven't referred to the fourfold above, as in many respects, invoking Heidegger here confuses the more clear cut architectural points made by Norberg-Schulz and others about the natural conditions of space and architecture's

(2010, p. 209) and Young (2006, p. 373) point out, the fourfold tends to be either ignored completely by Heidegger scholars or downplayed as merely nostalgic poetry or myth (for instance Krell, 1977, p. 321; Richardson, 1963/2003, pp. 570-572). Yet perhaps one of the most peculiar characteristics of an already peculiar concept is that, while it remains difficult and obscure in a philosophical context, it seems to be easily interpretable in an architectural one to the extent that Young (2006) has even suggested, writing on the fourfold, that architects "have understood Heidegger very much better than philosophers" (p. 391). The terms of the fourfold intuitively make sense in architecture because it is a spatial idea. The pairing of earth and sky is an understanding of the nature of the space we inhabit and a theme of architecture throughout its history while the term *geviert* is itself a spatial notion, being a word for a courtyard or quadrangle (Young, 2006, p. 373). The other two terms of the fourfold, the mortals and the gods, are also encountered as a matter of course in an architectural context. Architecture's history of religious patronage has meant that it has often been associated mainly with religious buildings where the purpose of architecture has been to mediate between the mundane and the divine.[211] Even in the modern period, with the declining relevance of religion and of religious buildings, the sense of the divine continues to have architectural relevance and one of the recurring questions of modern architecture is what building type could replace the former role of the church or cathedral (for instance Gropius, Taut, & Behne, 1919/1970; see also Harries, 1997, pp. 288-290, 328-329).

While each of the terms of the fourfold is familiar in architecture, so is their grouping together. A description of earth and sky is not just a description of space in general but of a vertical ordering of space—and one that, traditionally, has been directly associated with the other terms of the fourfold, gods and mortals, as a cosmological understanding of the world (see for instance Norberg-Schulz, 1975, p. 430). As Bateson (1979/1985, p. 28) has described with reference to

---

cosmological tradition. I refer to it here in order to help establish a new distinction between the different senses of the space of being part of the world.

[211] See for instance Harries' (1997, pp. 284-286) comments on Kostof (1985/1995), Norberg-Schulz (1975) and Pevsner (1943/1990).

Lovejoy (1936), the world was traditionally considered, in the West, to be ordered and structured in terms of a sort of deductive logic from its creator downwards. In this understanding spatial dimensions are interweaved with ontological ones—ranging from the infinite and immutable (in) heaven to the finite and mutable (on) earth (see also Wertheim, 1999). This mixing together of spaces and beings means that the pairings of the fourfold are reminiscent of this understanding beyond the shared terminology and thus, given the traditional relation between cosmology and architecture, are easily comprehendible in architectural terms.

This way of understanding the fourfold has advantages over other possible interpretations as it does not require its terms to stand in for other concepts or distinctions, as in Harman's (2002, pp. 190-204) and Young's (2006) accounts, while still being more substantial than excusing it as merely a retreat to poetic turns of phrase.[212] Harman (2002, pp. 193-194) has criticised understanding the fourfold as a description of the world (for instance by Richardson, 1963/2003, p. 572) as raising the question of why these four entities in particular are chosen and also of the contradiction between Heidegger's ontology and singling out any four entities or types of entities in particular. While understanding the fourfold as a reference to traditional cosmology makes sense of the choice of these terms in particular, it is also to understand reference to them as not being categorisations of particular types of entities. Vesely has, for instance, interpreted the fourfold in terms of a traditional cosmological understanding as two axes from the finite (earth, mortals) to the infinite (gods, sky) in terms of space (earth, sky) and time (mortals, gods).[213] This is to understand the world as a continuum, which makes sense within Heidegger's ontology and with what he refers to as the "mirror-play" (1950/1971, p. 177) between the terms of the fourfold.

---

[212] The account I have given is an obvious interpretation to make in the context of architecture. I have taken space here to establish it properly as it is not so obvious an interpretation in a philosophical context.

[213] In remarks during a conference paper which unfortunately are not in the written version (Vesely, 2010). Vesely accompanied this observation with a version of the diagram which Heidegger (1989/1999) introduces in *Contributions to Philosophy (from enowning)* (see Malpas, 2006/2008, pp. 225-228). Vesely interprets this in terms of its relation to similar diagrams of the world throughout architectural history and the traditional idea of the cosmos in terms of finite and infinite, space and time.

Yet although this understanding of the fourfold as a reference to a cosmological picture of the world, as suggested by interpreting it in an architectural context, makes sense of its terms, there remains the question of why Heidegger refers to this and why in this way. Is it a recourse to tradition and so an example of the tendency towards conservatism in Heidegger's work, such as his direct comments on architecture—with his praise of the Greek temple (1935/1977, pp. 168-170) and the traditional vernacular of the Black Forest farmhouse (1951/1977, p. 338)—and the association of his philosophy with totalitarian politics (Harries, 1997, pp. 152-166; Leach, 1998; Sharr, 2007, pp. 2, 113)? Such conservatism is interwoven with realism in the sense of there being an authentic or best way of acting that can be maintained or returned to and so an external (that is, real) standard to conform to. This conservatism is, however, not just present in the invocation of tradition in the fourfold but also by its spatial interpretation. To speak of cosmology, and so of the underlying structure or natural conditions of space, is (as I have noted above referring to my own projects; section 3.2.4) inevitably to speak of the world beyond our experience and so realism.

Yet the reference to cosmology does not necessarily lead to realism. The cosmological tradition is also an important reference for Bateson (1979/1985, p. 28; 1972/2000, p. 455) and in his interpretation it speaks of us being part of the world in a way that avoids realism, and with it the "dark side" (Leach, 1998) of Heidegger's account, and leads to a different sense of space. Bateson (1972/2000) describes a common everyday epistemological error—that "you see me":

> First, I would like you to join me in a little experiment. Let me ask you for a show of hands. How many of you will agree that you see me? I see a number of hands—so I guess insanity loves company. Of course, you don't "really" see me. What you "see" is a bunch of pieces of information about me, which you synthesise into a picture image of me. You make that image. (p. 486)

This is more than just a familiar criticism of naïve realism and implies the radical constructivist position as I have described it above. Bateson argues that the way we think about the world contains assumptions about epistemology such that in agreeing that "you see me" we are in fact agreeing to "certain propositions about the nature of knowing and the nature of the universe in

which we live and how we know about it" (p. 468) and that many of these propositions turn out to be problematic. Bateson's point is however not so much about our epistemological theories or terminology but rather about our thinking. Despite knowing that this is the case it is hard to train oneself to see the world in this way (p. 468) and these epistemological errors are self-perpetuating as we can get on perfectly well with our everyday lives while making these sorts of assumptions (p. 488). Bateson goes on to argue that this epistemological error is at the root of the ecological and social crises that we face because it opposes me to you and us to our environment by understanding us as separate entities (pp. 491-493). This opposition is also implied by Darwin's evolutionary theory where the unit of evolutionary survival is understood as the family line or the species. Bateson argues that the unit of evolutionary survival should instead be understood as the organism together with its environment because the organism that destroys its environment, as we given our advanced technology are now doing, destroys itself (pp. 456-457, 468, 491-493).

Bateson's account of ecology moves between the biological and the cognitive, understanding both in parallel through a comparison of genetic evolution and learning as both being stochastic processes (1979/1985, p. 160; 1972/2000, p. 255). His starting point for this is his drawing of a distinction, with reference to Jung (1916/1961), between two worlds of explanation—that of the *pleroma*, which is explained by physical forces and impacts, and of the *creatura*, explained by information (Bateson, 1972/2000, pp. 461-462, 488-489). As an example to distinguish the two he compares the actions of kicking a stone, which moves because of the transfer of physical forces, and that of kicking a dog, which moves because of its understanding of the information communicated in the action (pp. 489-490). The world of the *creatura* is a whole connected by circuits carrying differences—ideas or information (pp. 457-458, 490). These circuits along which differences can be transmitted pass outside of and between particular organisms. Bateson uses the example of a blind man walking along the street to illustrate this:

> Suppose I am a blind man, and I use a stick. I go tap, tap, tap. Where do I start? Is my mental system bounded at the handle of the stick? Is it bounded by my skin? Does it start halfway up the stick? But these are nonsense questions. The stick is a pathway along which transforms of difference are being transmitted. The way to delineate the system is to draw

> the limiting line in such a way that you do not cut any of these pathways in ways which leave things inexplicable. If what you are trying to explain is a given piece of behaviour, such as the locomotion of the blind man, then, for this purpose, you will need the street, the stick, the man; the street, the stick, and so on, round and round.
>
> But when the blind man sits down to eat his lunch, his stick and its messages will no longer be relevant—if it is his eating that you want to understand. (p. 465)

It is possible to think of the whole world in this way as interconnecting pathways of differences linking us with our environment in terms of both cognition and evolution.[214] Bateson (1979/1985, p. 28; 1972/2000, pp. 344, 455-456) understands this, following Lamarck (1809/1963), as an inversion of the great chain of being (see also Gillispie, 1958). In that traditional understanding, as described by Lovejoy (1936), the organisation of the living world was structured with Mind at the top, invoked as an explanatory principle for all other beings. In his evolutionary theory Lamarck inverted this hierarchy. Instead of order being deduced from above, it was the order of the whole that is formed from below and Mind becomes that which needs to be explained rather than something which can be invoked as an explanatory principle (on explanatory principles see also Bateson, 1972/2000, pp. 38-58).

Bateson's approach to ecology is significantly different to contemporaneous understandings which treated the world as a system in terms of its energy and resources (e.g. Buckminster Fuller, 1969/2008) or as something to be modelled predictively, such as the approach of Forrester (1971), and also to more recent characterisations of ecological crisis as a practical problem to be solved through technology.[215] Bateson is concerned with information rather than energy or resources and sees our environment and our minds as being fundamentally integrated

---

[214] See also Raunig (2010) and especially his bicycle example (p. 19).

[215] See also Rawes (2013).

together (the world of the *creatura*).[216] This connection between the ecological and mental is made clear in his discussion of the pollution of Lake Erie:

> When you narrow down your epistemology and act on the premise "What interests me is me, or my organization, or my species," you chop off consideration of other loops of the loop structure. You decide that you want to get rid of the by-products of human life and that Lake Erie will be a good place to put them. You forget that the eco-mental system called Lake Erie is part of *your* wider eco-mental system—and that if Lake Erie is driven insane, its insanity is incorporated in the larger system of *your* thought and experience. (Bateson, 1972/2000, p. 492)

That is, we are not just within and dependent on an ecological system but are an integral part of it in our observation, learning and acting. We cannot solve ecological problems through technological means or ad hoc measures but only postpone them (pp. 496-497) and indeed such technological thinking perpetuates the problem, understanding the environment as something that we can master. Understanding ecology in terms of Mind, the root of ecological crisis is epistemological rather than practical or technical. The kind of thinking implied by Darwin's evolutionary unit of survival, by the realist premise behind saying "you see me" and by technological instrumentalism, where we see ourselves as separated from each other and as separate to our environment, leads, given our technology, to us destroying our environment as well as acting in competition with each other (pp. 468, 493). The way to respond to this is therefore, in the first place, not technological or practical but to reform our thinking in order to see ourselves as part of the world—and so as me *and* you, as us *and* our environment.

It is possible to draw several parallels between the account that Bateson gives of ecology and that which Heidegger gives of dwelling, despite both having very different subject matter and points of reference. As well as the common root of both ecology and dwelling in *oikos*, or the

---

[216] As Goodbun (2011, p. 42) has noted, Bateson's position is closely related to Lovelock's (1972) Gaia hypothesis, which it prefigures.

household, both Heidegger and Bateson move the question at hand (the crises of dwelling and ecology) away from practical or technological solutions towards the question of how we think about the world.[217] Both criticise the separation between entities implicit in objectivity and encourage us instead to think about the world as an interrelated whole. In this sense both Heidegger and Bateson invoke the idea, although not the detail, of cosmological thinking with Bateson openly referencing it and Heidegger hinting at it through the fourfold. While they are different sorts of distinctions, what Bateson distinguishes as the world of the *creatura*, governed by difference rather than the physical forces of the *pleroma*, has similarities with Heidegger's (1927/1962) key concept of readiness-to-hand, which describes the invisible relations between entities as opposed to their present-at-hand qualities as discrete objects. In both cases this is manifest in similar criticisms of technology and technological thinking as tending to treat the world as if it is separate to us.

There are however also significant differences beyond the obvious ones of context and sources. A major feature of architectural readings of Heidegger is the emphasis on place as a criticism of the anonymity of modernism (Frampton, 1983; Norberg-Schulz, 1980; Sharr, 2007, pp. 50-58). The notion of place brings with it a connection between dwelling, identity and landscape which, given Heidegger's political history, is uncomfortably close to the blood and soil rhetoric of Nazism (Harries, 1997, pp. 152-166; Leach, 1998; Sharr, 2007, pp. 2, 113). In Bateson's ecology of Mind there is no such emphasis on place or, indeed, on any specific instances over others. On the contrary, the definition of any one system with respect to others is arbitrary and according only to what it is that is to be explained (Bateson, 1972/2000, p. 465). The whole eco-mental system of the *creatura* is to be understood as one whole—we are a part of everything and everything is a part of us. This difference is similarly noticeable in the contrast between the heterarchical ordering of Bateson's ecology of Mind, which is constantly changing and so indeterminate because we are (all) part of it, and the concept of authenticity in Heidegger, of one particular way of being which is

[217] That the conclusion of "Building Dwelling Thinking" (Heidegger, 1951/1977) is an attitude to thinking—that "as soon as man *gives thought* to his homelessness, it is a misery no longer" (p. 339)—is sometimes rather lost within architectural accounts. See also Mitchell (2010) on the fourfold as "a thinking of things" (p. 208).

valued above others.[218] Both the emphasis on place and the idea of authenticity can be traced back to the difference between Heidegger's phenomenology and Bateson's cybernetic epistemology. For Heidegger the phenomenological method is an attempt to reveal hidden aspects of the world beyond its mere appearances. Although this is not a claim to objective correspondence, and even incorporates a form of circularity in the sense of the hermeneutic circle, it nevertheless is a claim to truth in a sense (to reveal something about the world) and so is in contrast to the understanding of cybernetics and radical constructivism.[219]

As I see it, the differences I have highlighted are each clear advantages of Bateson's cybernetic account over that of Heidegger. While there are similarities that are brought out by the mutual reference to traditional cosmology, the cybernetic position avoids the pitfalls of realism and conservatism with which references to Heidegger become entangled. The difference between these two accounts also leads to a different sense of the space of being part of the world. I have not managed to differentiate this so far in the design projects I have presented. In order to do this here I turn to a case study—an installation by Permanent Waver titled Light Well (Figure 109-Figure 110) which I reviewed (Sweeting, 2011c).[220] My reasons for using this example are somewhat anecdotal in that it (fittingly) includes me (Figure 110, lower middle and bottom) and also my own drawing of the distinction I am about to suggest. Light Well sits in a courtyard. At first sight it appears to be just a long table. The surface has collected rainwater and is tilted so that the water is deeper at one end.

---

[218] In this respect, while Cox (2006, pp. 151-155) notes various similarities between the notion of authenticity in Heidegger and Sartre, I find them at odds. For Sartre, authenticity is living in one's freedom and responsibility and, as such, it is broadly compatible with the position I have set out in that it does not preference any one way of living over another (see for instance Sartre, 1943/1969, p. 627).

[219] Other notable contrasts can be made between the non-anthropocentric nature of Bateson's Mind with the priority Heidegger (1927/1962) gives to *Dasein* (although the later Heidegger and also Harman's (2002) reinterpretation of the tool-analysis move away from this) and between the emphasis Heidegger (1927/1962) places on our finitude and Bateson's (1972/2000, p. 471) contrasting suggestions about death.

[220] Permanent Waver is a collaboration between Tim Norman, Pernilla Ohrstedt and Matthew Wilkinson. Light Well was a site specific installation for the exhibition "FLOCK: Tell Stories" at the Garage, Brompton Design District, 17-25th September 2011, as part of the London Design Festival.

The metal plate that forms the surface is part way through rusting and the water drains to a nearby grate when it overflows (Figure 109, middle). Mixed in with the water is a little oil which, when viewed from a particular angle, colours and distorts the reflections of the sky and courtyard walls above (Figure 110, top). It is easy to understand Light Well as articulating the structure of space between earth and sky.[221] This is not to say that Permanent Waver explicitly intended Light Well to address these themes but, like much architecture, it implicitly does so (the significance of the idea of the "latent ground of the natural world" (Vesely, 2010) is that, by definition, it can be encountered everywhere). In encountering Light Well, its reflecting of the sky and catching of the rain reminds us of the verticality of the space in which it sits while the materiality of its rusting, the horizontality of its surface (the table itself but also the liquid it contains) and the draining away of the water emphasises the ground it sits on. Such an interpretation of architectural elements as standing for earth and sky, whether through culturally established convention or through their natural associations, is characteristic of discussions of architecture in phenomenological terms (see for instance Norberg-Schulz, 1980; 1986, pp. 223-230; Vesely, 2004, pp. 384-387).

However, to see the installation in this way is not immediately obvious and this is crucial to it. To view the reflection of the sky above one needs to lean over the water (Figure 110). If one does not do this—and perhaps one wouldn't without prompting—then it seems to be just an object and it no longer articulates the courtyard or refers to the sky. What is significant about this is that, having discovered the way the table articulates the courtyard by leaning over it, one becomes conscious of one's own incorporation in this. One does not read it objectively at a distance but as part of it, integrated and embodied in a set of relationships with the world not through their representation as symbols but by becoming aware of the network of differences one is part of. Rather than understanding Light Well as a representation or symbolisation of the world in terms of earth and sky (as would be a conventional phenomenological reading), we can instead use it as an instrument to explore the interconnection between us and our surroundings.

---

[221] The space in which Light Well was placed is itself reminiscent of the fourfold, Heidegger's term for which, *das geivert*, is a term for courtyard (Young, 2006, p. 373).

In this sense, the more explicit references to the sky and earth that I have noted in Light Well are unnecessary—it is its incorporation of the observer that gathers the surrounding world around this action. I have therefore taken to thinking of this communication as being in terms of communicating the act of communication rather than any specific content. Such an understanding of communication makes sense with various aspects of my preceding discussions. It allows the content of communication to remain indeterminate and so avoids implying that there are correct and incorrect interpretations. It is reminiscent of how in conversation theory learning about the topic of the conversation is secondary, and is a means, to learning about the other (Barnes, 2007, p. 81).[222] While I have used a case study to introduce this idea, it is also present in aspects of my own projects, such as in the observation, which I made above, that the most significant quality of the Allotment Calendar is the sense of connection that it establishes, rather than the information that it presents.

The spatial experience of the communication of communication is epistemological rather than symbolic in that, rather than where some particular meaning is shared, it is where the observer's observation becomes observable. I propose this interpretation of the spatial sense of our being part of the world as an alternative to the architectural theme of place, as it has been understood in terms of phenomenology, that is still concerned with architecture's experiential qualities and with articulating our presence in the world but in a way that is focused on the observer rather than on the specifics of a particular location.

It is, however, not immediately clear how such a space can be created. Light Well is just as easily interpreted in terms of conventional symbolism or simply in aesthetic terms and the spatial experience I have described is as dependent on how one thinks about it as any of its actual architectural properties. There is therefore a sense that, because this spatiality is epistemological rather than actual, one can experience it anywhere and about anything because it is not formed by

[222] Hence the etymological relation between communication and words such as communion, common, community, commune and so on. This association with what is common is also behind Vesely's (2004) use of "communicative" in describing architectural space.

the actual qualities of the architecture but by us in our thinking about it. To do this is, however, not necessarily easy, remembering Bateson's (1972/2000, p. 468) comment that it is hard to genuinely think in this way. The architectural question that follows is therefore not what architectural qualities form this spatiality for us, but what architecture is helpful to *us* in forming it epistemologically. I return again to this question below (in section 4.2).

Figure 109: Light Well by Permanent Waver (Tim Norman, Pernilla Ohrstedt and Matthew Wilkinson).
Top: View from basement courtyard level. Middle: The draining away of the water. Bottom: View from above with reflection of sky through courtyard. Photographs by Tim Norman.

Figure 110: Leaning over Light Well to see the reflection.
Top: View looking down at Light Well from leaning over it with reflection of sides of courtyard, sky and photographer. Upper middle: stirring the water a little causes the depth of the reflections to disappear and the water to become a surface with its own textures and patterns. Lower middle and bottom: These photographs happen to include me as I stooped over the surface of the water, staring at the sky, and became explicitly aware of doing so and so of my implication in my spatial experience of the table. Photographs by Tim Norman.

4.1.3 The ethics of ethics and the ethics of architecture

The third of these three intersections is a development of that between ethics and architecture which I have outlined above, drawing on Harries (1975, 1987, 1997), in terms of the way that both propose ways in which to live. In reflecting further on this idea, I have begun to see the ethical questions of designing architecture as being in parallel to what I have thought about as being the ethical questions of ethics (that is, those ethical questions which apply to our conduct in deliberating or discussing ethical questions; von Foerster's (1990/2003, pp. 290-291) comments about the articulation of ethics leading to moralisation are one example of this). That is, ethical questions about how to go about designing architecture are similar in status to questions about how to deliberate over ethics. We can therefore differentiate the question of the ethics of designing architecture from that of the ethics of the architecture we design and, in the same way, the ethics of our ethical questioning from that of the answers that we put forward to such questions. This emphasises our responsibility for how we act and for our relations with others without specifying how we should take responsibility or how we should relate to others and so disassociates these ethical questions from the search for right answers (and so moralisation).

In both designing architecture and the general case of considering ethics, our action forms a self-reference where any answer to an ethical question raises another regarding how we have come to and how we have presented this answer.[223] For instance, where we design a building in a particular way, we can evaluate not just this proposal in ethical terms but also the way in which we have developed and presented it. Similarly, where we act in some way or where we advocate some principle as being a good one to uphold, then it is not just the actions or principles at hand that can be evaluated in ethical terms but also the way in which we have come to our decisions about them.

[223] It is this self-reference that is behind von Foerster's point that ethics cannot be articulated—that in trying to express an ethical idea in language, the language that we use brings other moralising meanings with it (see Bröcker, 2003, pp. 52-53).

There are ways of considering how to respond to ethical questions which make it possible to consider the ethics of how we do so and some which obfuscate this. Some forms of reasoning will, for instance, involve or exclude others or will enable us to take or avoid responsibility for our decisions. This is evident in the design process where automated processes such as deterministic rules or optimisation obscure our responsibility and leave no room for others (as discussed above in Part II). This can also be thought of in more generally relevant terms. For instance, where one understands ethics in terms of moral codes, it is not possible to distinguish the question of the ethics of ethics as there is no need for ethical deliberation, only the practical matter of following the rules given by the code, and it becomes impossible to take responsibility or to genuinely involve others. My point here is not that moral codes are "ethically wrong" but, rather, that they obscure the possibility of considering the ethics of invoking them.

It is only where one understands ethics as being one's own responsibility that how to act in this responsibility also becomes an ethical question. At the end of Part II, I summarised three aspects of design as being of relevance to ethics: (1) the way designers approach there being no right answer to a situation; (2) the reflexive dialogue that designers construct with others; and (3) the pursuit of intrinsic rather than just extrinsic purposes. These are instances of ethical questions being implicit in the epistemology of designing, which I have argued enables designers to approach complex ethical circumstances in ways that have advantages over conventional (deontological, consequentialist) normative ethical reasoning, at least in the context of those wicked problems which designers face. Part of the significance of ethical questions being implicit in designing is that, in contrast to the application of a given ethical theory or a moral code, they make it possible to reflect on the ethics of one's conduct as *part of* one's action and so to take responsibility for how one does this. Again, my point here is not that these ways of acting are "ethically good" but that they are ways of thinking about ethical questions in which it is possible to simultaneously consider the further ethical questions about how we are doing this and so which are "ethical" in the sense of involving ethics. This is to keep ethics implicit in our action in terms not just of keeping our values implicit rather than explicit—which is von Foerster's (1990/2003, p. 291) main point—but also in terms of our ethical reasoning being integrated into our acting.

4.1.4 Summary: Being part of the world, again (epistemological, ethically, spatially)

In the previous three sections I have used some of the ways in which I find that my investigations in Part II and III intersect with each other in order to form some joint conclusions to those parallel investigations. These conclusions are developments of the epistemological, ethical and spatial senses of the idea of our being part of the world with which I began. These involve new or revised understandings. Some aspects of these are relevant in particular to me and to my interests, being significant to me because they provide a way in which I can move forward (which I introduce below in section 4.2). Some aspects are of more general relevance in that they suggest ways in which epistemological, ethical and spatial ideas can be related to each other in architecture which have significance beyond the specific concerns of my own work.

The first intersection which I have discussed is that of how both our experience of architecture (Pask, 1969, p. 495) and the activity of drawing (Glanville, 2007e) can be understood in terms of conversation and so the epistemology of our being part of the world. My account during Parts II and III has drawn on these observations at varying levels of explicitness: firstly, in discussing the design process as a conversation; secondly, in giving an account of my own development of each project and of one project from the next; and, thirdly, in evaluating how I expect the projects I have proposed would be interpreted. I have argued that bringing these two ideas together suggests insights for thinking about architecture as a communication medium.

The personal significance of this is the way that I have understood aspects of what is successful in my previous projects in new ways. It is where qualities of my drawings (rather than what information they present) have related to the spatial qualities with which I have been concerned that the drawings have been most successful. The drawing process I have practiced has incorporated accidental marks (particularly with the specific ways in which I have used often rather run down photocopiers which have tended to emphasise finger prints and smudges which are hardly noticeable on the originals), repetition (the hatching and the photocopying) and the juxtaposition of precision with inaccuracy (for instance, in making very precise marks which are measured only by

eye). These are all qualities which relate to aspects of what I enjoy most architecturally: the physical traces left by events; the repetitive rhythm of everyday situations; and the contingencies of the things we create. While I have always been aware of these relationships, I now see the potential to generate new architectural ideas by manipulating these spatial qualities within the actual space of a drawing in a way which complements how a drawing's abstraction allows me to model the spaces I imagine. This is significant to me as it suggests a different approach that I can take to the architectural questions with which I am interested (the spatial sense of our being part of the world) which draws on my previous work but takes off in a new direction (see 4.2 below). It has also influenced my teaching practice where, over the last two years, I have encouraged students more and more to conduct their spatial investigations in part through the manipulation of the actual spatial qualities of their drawings and models.[224]

As well as its significance to me, this idea has relevance more generally beyond my own particular concerns. It strengthens the relation between drawing and the epistemology of designing by understanding the activity of drawing and the interpretation of architecture as being similar in terms of their epistemological qualities. This is a contribution to the understanding of design's epistemological foundations and one that potentially bridges between research into design's foundations and questions about architectural form and expression. It also suggests a way of talking about architecture as a communication medium which has advantages over doing so in terms of coding. Firstly, to discuss architectural communication in terms of conversation is to do so in design's own terms and so avoids importing theories external to design into design discourse. Secondly, it doesn't require any prior agreement of what is to be communicated or how this is to be done (on which architecture has traditionally depended and which, beyond banal examples, is difficult to achieve in modernity). Thirdly, it suggests a way of thinking about architecture as a medium in which it is possible (for the designer) to try to communicate, as opposed to something

[224] A recent example of this is a project by Kate Cronk who explored the spatial quality of ghostliness through a series of physical experiments such as modelling items on verge of presence in terms of their thinness, fragility or blankness in relation to the process of making them.

which is analysed for its meaning as part of culture, without this implying that the architect unilaterally determines the meaning of the architecture.

The second intersection I have discussed is that between the spatial and epistemological senses of being part of the world. While my projects in Part III have attempted to find architectural expression for our being part of the world, they have become entangled with realism and so, instead, with the idea that we are apart from the world. This has been especially the case in the Café Bohemia and Hackney Churchyard projects where I have drawn on ideas of what is common in spatial experience as discussed in architecture's phenomenological tradition. By, firstly, examining some of the ideas in Heidegger's discussions of dwelling and the fourfold that these architectural accounts draw on and, secondly, building a more detailed comparison between these and cybernetics through Bateson's account of ecology, I have clarified the differences between these two positions and have suggested a more distinctively cybernetic account of the spatiality of being part of the world.

The significance of this for me personally is that it has allowed me to clarify a distinction which I have hitherto struggled to make. This has suggested a different way of exploring the architectural qualities with which I am interested which is less about our presence in a specific place or that place's presence around us but is instead concerned with the space created by our exploration of our experience. This opens up new avenues of architectural investigation which I have begun to explore, as I introduce in section 4.2 below.

This revised spatial sense of being part of the world is also more generally relevant. Phenomenological accounts of our being-in-the-world tend to revolve around dwelling, tradition and place. In doing so, they easily become associated with realism and conservatism. The way I have suggested developing this spatial idea provides a way of breaking with these associations while still exploring our being part of the world and discussing architecture in terms of our experience of space rather than its objective properties (which is the reason Norberg-Schulz turned to phenomenological references). In doing so, this gives added weight to the etymological connection between dwelling

and ecology (*oikos*) and suggests one way that ecology can be understood as a spatial and architectural idea.

The third intersection I have discussed is one aspect of the relation between ethics and designing architecture. Beginning from the idea that, as Harries (1975, 1987, 1997) argues, to propose architecture is to propose an ethos, I have developed the idea that the ethics of designing architecture is akin to the ethics of our conduct in deliberating about ethics. Both when we address ethical questions explicitly and when we design architecture, our action involves a self-reference such that how we respond to an ethical question is also an ethical matter and can be questioned ethically. This self-reference is at the root of von Foerster's (1990/2003, pp. 290-291) comments about the difficulties of articulating ethics (see Bröcker, 2003, pp. 52-53) and also the parallel between von Foerster's argument and the ethical difficulty designers encounter due to being unable to avoid their actions impacting on others in ethically significant ways (see above section 2.1.3).

The personal significance of this to me is the challenge of acting it out in my designing. In particular, the difficulties I have found with the Café Bohemia and Hackney Churchyard projects make sense in these terms, as in approaching them by looking for commonalities I tended towards realism in my thinking. In how I have begun to move forward (as discussed below in section 4.2) I have tried to avoid this difficulty by trying to communicate the process of communication rather than any specific idea.

The general significance of focusing on the ethics of ethics is that it is possible to disassociate our approach to ethical questions from the search for right answers without this entailing arbitrariness. This understanding consolidates the three aspects of the epistemology of design which I have emphasised above (in Part II) as being of relevance to ethics—the way designers approach there being no right answer to a situation; the reflexive dialogue between designers and those they design for; and the pursuit of intrinsic rather than just extrinsic purposes. Their significance is that they are ways in which we can implicitly consider the ethics of our action as part of our acting. As this approach to ethics is one that makes sense in design's own terms, it is a contribution to design's disciplinary foundations and complements the idea that the discipline of

design should develop its own epistemological foundations rather than needing to be underpinned by scientific method. This provides an alternate way to approach ethical questions in the context of architecture to doing so by importing external ethical theories into architectural discourse and is also of relevance to how we speak and reason about ethics more generally.

4.2 Moving forward: Epistemological theatre

4.2.1 Beginning another design investigation

The purpose of this section is to suggest a way of exploring the three ideas that I have developed from the intersections between my work in Parts II and III in a new design investigation. This is partly in order to examine these ideas by exploring their consequences in design and partly to develop them further in doing so. I had initially found it difficult to move forward after the Hackney Churchyard project and abandoned several attempts to do so as they merely repeated previous investigations rather than asking new questions. I have used the process of writing this text in order to reflect more deeply on my previous projects and while the work I present here is still concerned with my original aim of heightening our experience of being part of the world, my approach to this has now changed significantly.

Of the three ideas noted in the previous section, the one that has the clearest architectural potential is the second, where I have suggested a distinctively cybernetic version of the spatial aspect of our being part of the world and the architectural theme of place. As noted above, this does not lead directly to architectural or spatial forms. The spatiality I have suggested is epistemological rather than actual and it is therefore a quality of how a space is thought about rather than of its objective properties. The design question that this raises is therefore not how to form such a space architecturally but in what way architecture might help its observers to form such a space in their act of observation. This is to think of architecture as working like an instrument and to focus on communicating the act of communication rather than some idea in particular.

This idea also relates in part to the other two ideas discussed above. Firstly, the idea that part of the significance of drawings is that we experience them in similar epistemological terms to what they propose, seems particular relevant to trying to construct an epistemological space and I have therefore chosen to begin this project by experimenting within the spatial field of drawing (as discussed below; sections 4.2.2 and 4.2.3; Figure 111-Figure 131). Secondly, in terms of considering the ethics implicit in my approach to designing, shifting my concerns to the communication of

communication rather than of some specific idea, avoids the difficulties I have encountered in my previous projects where they have in part implied the realism of being apart from the world (with the ethical consequences that go along with this).

I have begun by analysing the body of drawings I have accumulated in my previous projects. Looking at this collection of drawings as a whole, I have identified some of the spatial qualities that these drawings have *as drawings* (as opposed to the spatial qualities of what I have proposed in them) that I might use in constructing the sort of epistemological space I have suggested. I have made new drawings that emulate these aspects and in so doing have explored some of their possibilities. This investigation has, so far, had two phases. In the first, I have explored the dense hatching which has been a feature of many of my drawings by carrying this out at a larger scale and with more intensity than I have done previously in order to test this method to its limits. In the second, I have developed some of the compositional strategies which I have regularly adopted such as the overlapping of elements, an edgeless quality to forms and the creation of tension between, on the one hand, regularity and precision and, on the other, variation and inaccuracy.

I am here presenting only the beginning of a project. It would of course in many ways be preferable to have made more progress and to reflect on it as a finished body of work. However, if it were successful as a project, I would hope it would lead to the beginning of a further investigation and so it therefore seems appropriate to conclude on something that is in progess, suggesting a new avenue of exploration made possible by my previous work.

4.2.2 Study (1): Hatching

The most distinctive feature of many of my drawings is their dense repetitive hatching. In the first of the two studies I present here, I have tried to further explore some of the spatial qualities which this suggests. Of my various uses of hatching in the above projects I find it most interesting in the Contingency project where it was part of my process for generating the sorts of contingent forms in which I was interested. The most spatial quality that I see in the hatching itself is the combination of its endless repetition with the minor variations in each stroke, especially in the unmeasured widths between the lines and the raggedness of their ends. These variations are not

something I would attempt to amplify but followed from the tolerances of drawing relatively quickly and without measurement other than by eye. This combination of repetition and variation has some sympathy with the aspects of daily routine and exceptions from this with which I was concerned in the Allotment Calendar and other projects and which I see as an important characteristic of typical everyday situations. In this sense it is an example of the sort of spatial idea that can be seen in the drawings themselves independently of what those drawings propose.

These qualities are not ones I initially intended in the drawings but something I found and enjoyed in my work. This gave me something else to explore and I've experimented with different sorts of mark making (subtle changes in the way I made the hatching; smudging; incorporating collage) and with changing the process of photocopying (using reduction and enlargement to change the tightness of the line work; using different photocopiers for different parts of the process of making a drawing; creating depth by varying the layering of the tracing paper). That is, I was designing in my exploration of the possibilities of this process.

In the set of drawings that I present here (Figure 111-Figure 117), I have tried to explore the spatiality of the sort of hatching which characterised these earlier drawings by emulating it in a more extreme way. The process consisted of adding layers of hatching over enlargements of previous layers and repeating this process. The enlargement transformed the nature of the previous marks in two different ways. Firstly, after several iterations the widths of the lines became thicker so that they could be read as elements with a thickness rather than as one-dimensional lines. Secondly, the space between the lines increased leaving more space in which to make new marks, counteracting the tendency of the drawings to clot up as they would otherwise with so many layers of pen work.

I began with a small A5 block of hatching, drawn with a 0.35 pen. Enlarging this to A1, I hatched over this with a 0.18. I then divided this A1 sheet into quarters and, enlarging these again to A1, hatched over each with the 0.18 with slightly different densities and orientations. Lastly I divided each of these four new drawings into two and, enlarging them once more to A1, hatched over each once more, this time with pencil work. When the resulting eight A1 drawings are assembled

together (Figure 115) it is possible to shift view between seeing them with different stages as being dominant and so either as one whole (looking at the original 0.35 and 0.18 marks), as quarters (the second layer of 0.18 marks) or as eighths (the pencil marks). These three ways of reading the combined drawing are each exaggerated by the inaccuracies of using a manual feed for tracing paper on a plan copier which creates slippages between the orientation of the copied marks and the edges of the sheet.

The various layers are flattened into each other by the photocopying process so that they become indistinct where they cross each other and it becomes difficult to tell which marks were made over which others (even for me, who made them). This is different to where the hatching of the Contingency project drawings (for instance Figure 4) could pass either over or behind various elements and so occupied a definite place in the depth of the drawing. The difference is that these drawings have only hatching and none of the gaps with which I had indicated elements in the earlier drawings—they are all ground and no figure. This gives an oscillating quality to the drawings which appear both to have an endless sense of depth—where each layer jumps to the back of each other in turn, receding into the depth of the paper space—and also as being completely flattened onto the surface of the paper.[225]

There are different senses in which the qualities of these drawings relate to our being part of the world. The mark making of the hatching is a registration of my presence in making it in a similar sense to the value that mark making is sometimes given in painting such as in tachism or abstract expressionism (and most particularly, given the gridded geometries of these drawings, the work of Agnes Martin). Another, which is more spatial, is the ambiguity of the marks in terms of

[225] See similarly Krauss' (1979) discussion of the association of grids with both the material and the spiritual, which is supported by the dual qualities of their spatiality, where one is drawn both to their surface materiality and to their infinite extension. There is also a similarity with Eisenman's repetition of grids and other features at different scales or in conflict with each other such that their repetition casts the other into question.

their edges, depth and extent. The lines build up a field, blurring distinctions rather than creating them, and making an amorphous, edgeless space.[226]

The aspect of the drawings which I find most relevant, given what I have said above about epistemological space, is the way that one can become enmeshed in their space in viewing them (which is another parallel with abstract expressionism). One can move one's focus from one set of marks to another, seeing them alternately in different orders of depth or as one flat pattern, and from seeing the drawing as one whole field to a collection of individual marks. The variations of one layer of hatching interfere with those of others and, particularly where I have left wider gaps than usual, emphasise each other. In looking at each line separately, one repeats the marks that I made by following the lines back and forth (in a similar way to how one moves visually through a plan drawing) exploring the similarities and differences in each repetition.

[226] These are therefore quite different sorts of lines to the distinction making ones that Glanville (1999a) discusses. See also the way that Beesley (2007) is concerned with "figures…riddled with ground" (p. 20) and the blurring of the lines between oneself and the world (p. 27).

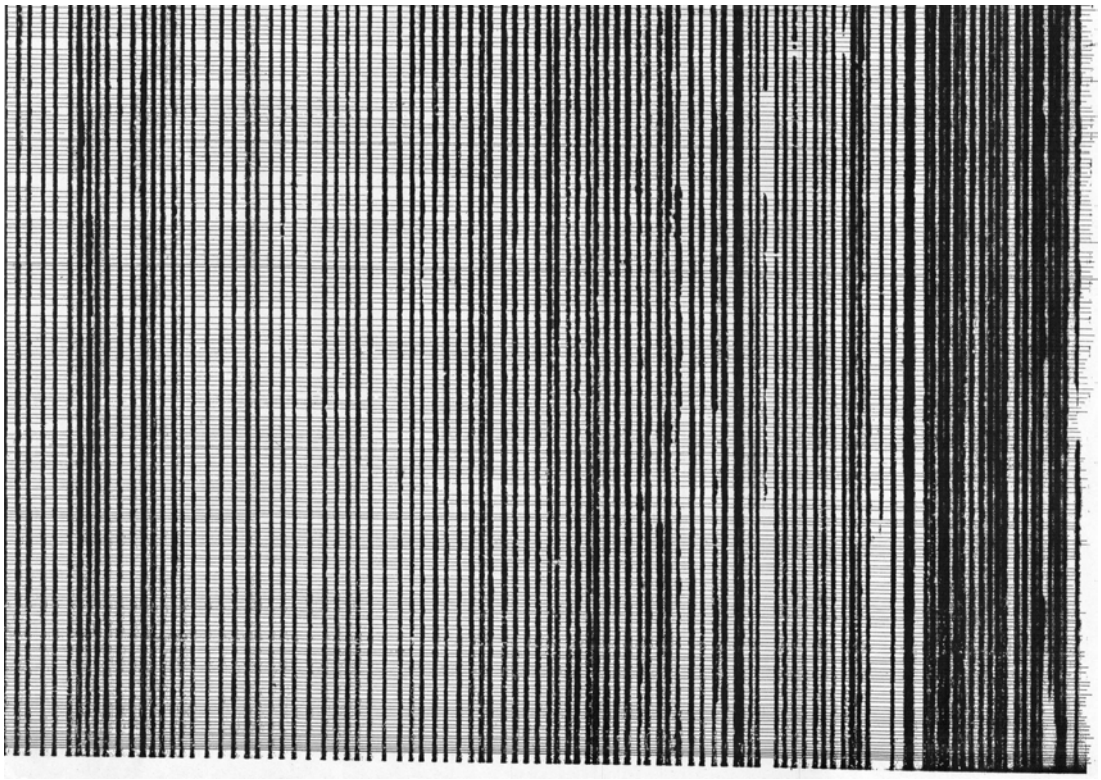

Figure 111: Hatching study (1).

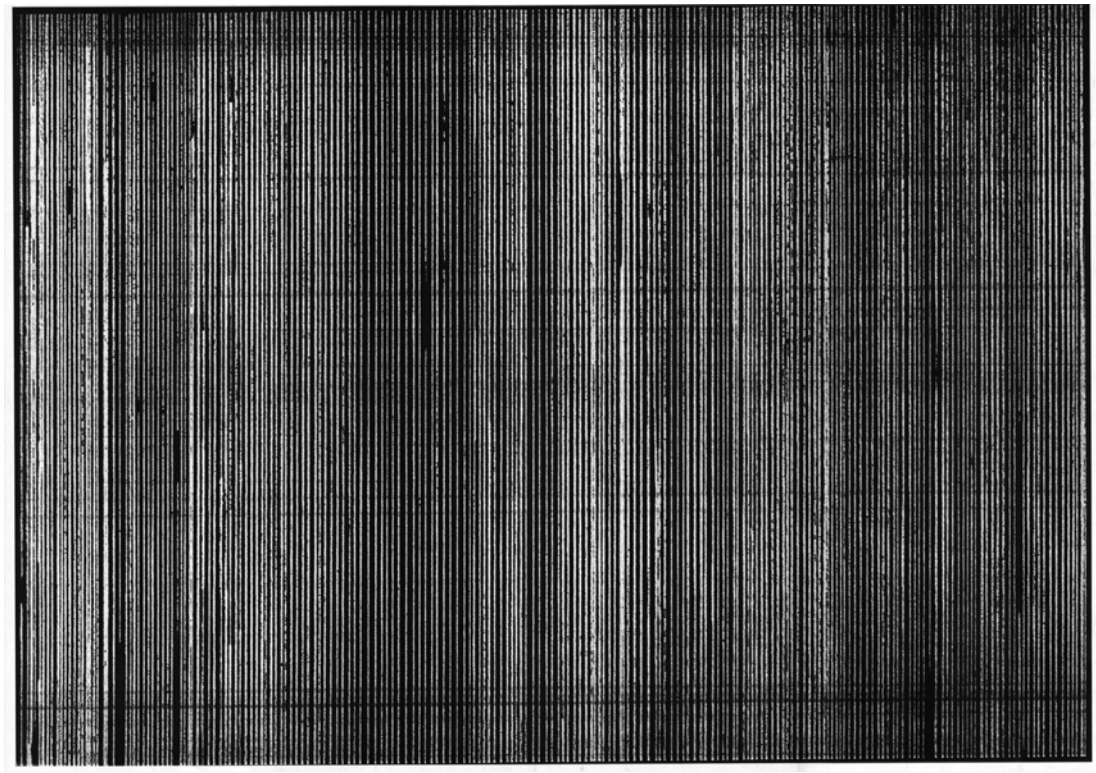

Figure 112: Hatching study (2).

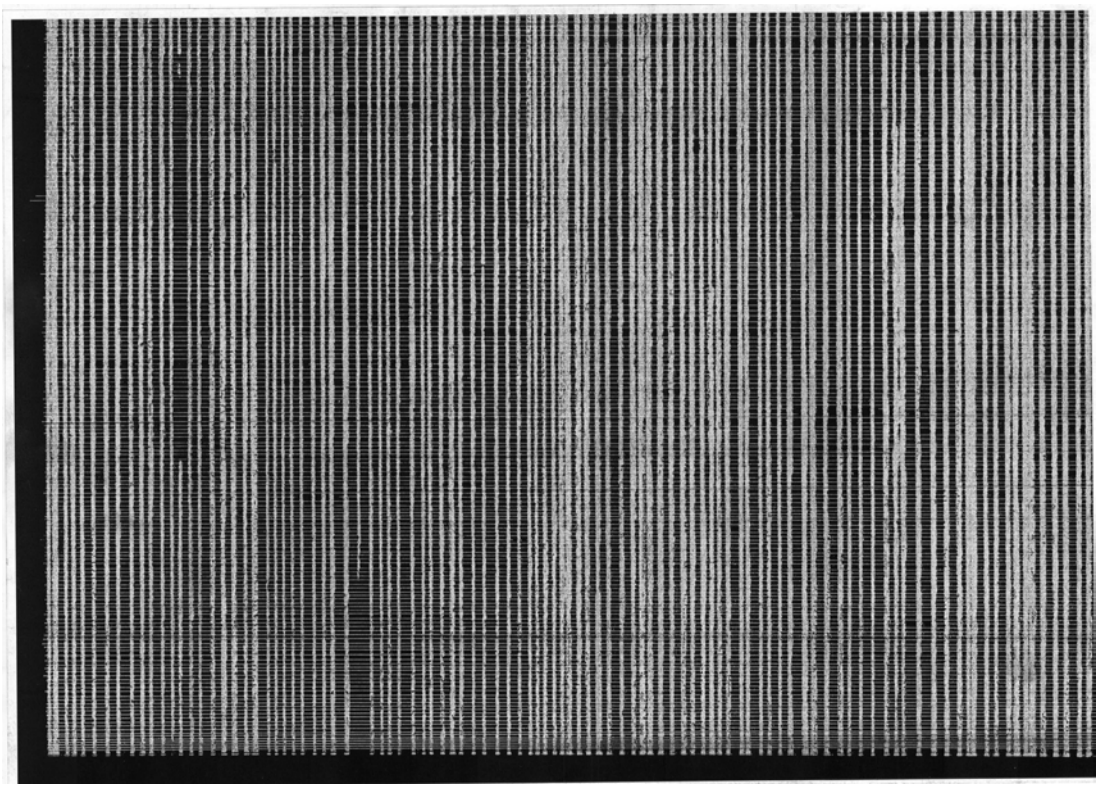

Figure 113: Hatching study (3).

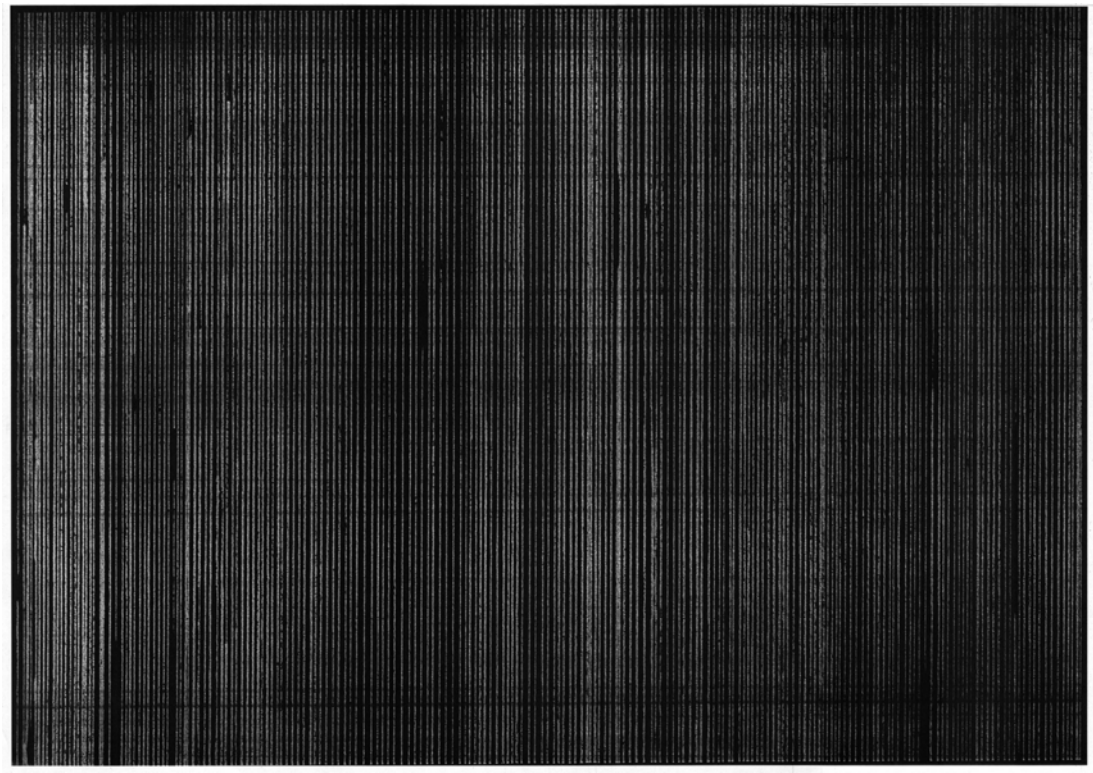

Figure 114: Hatching study (4).

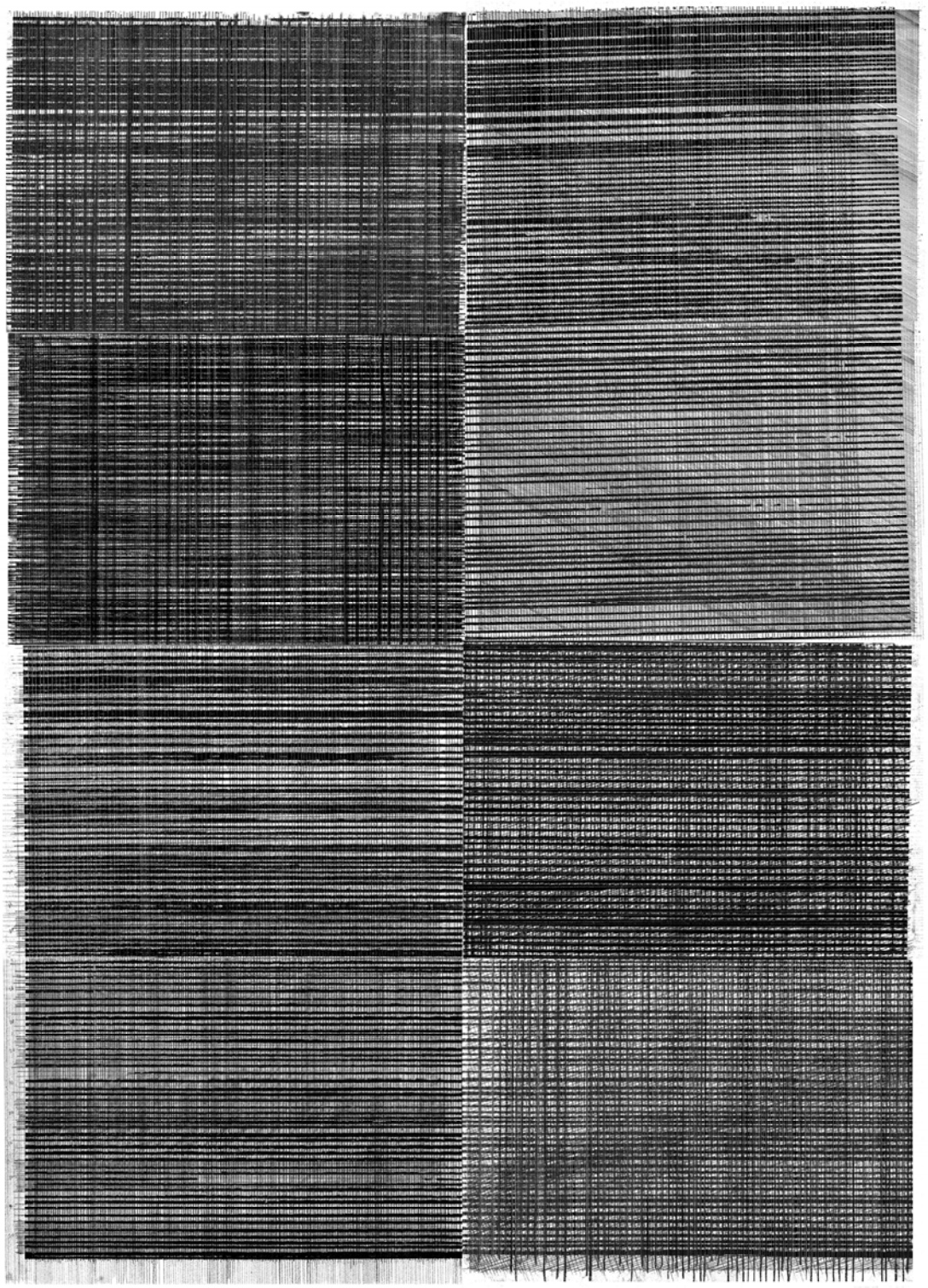

Figure 115: Final hatching study (8xA1s).

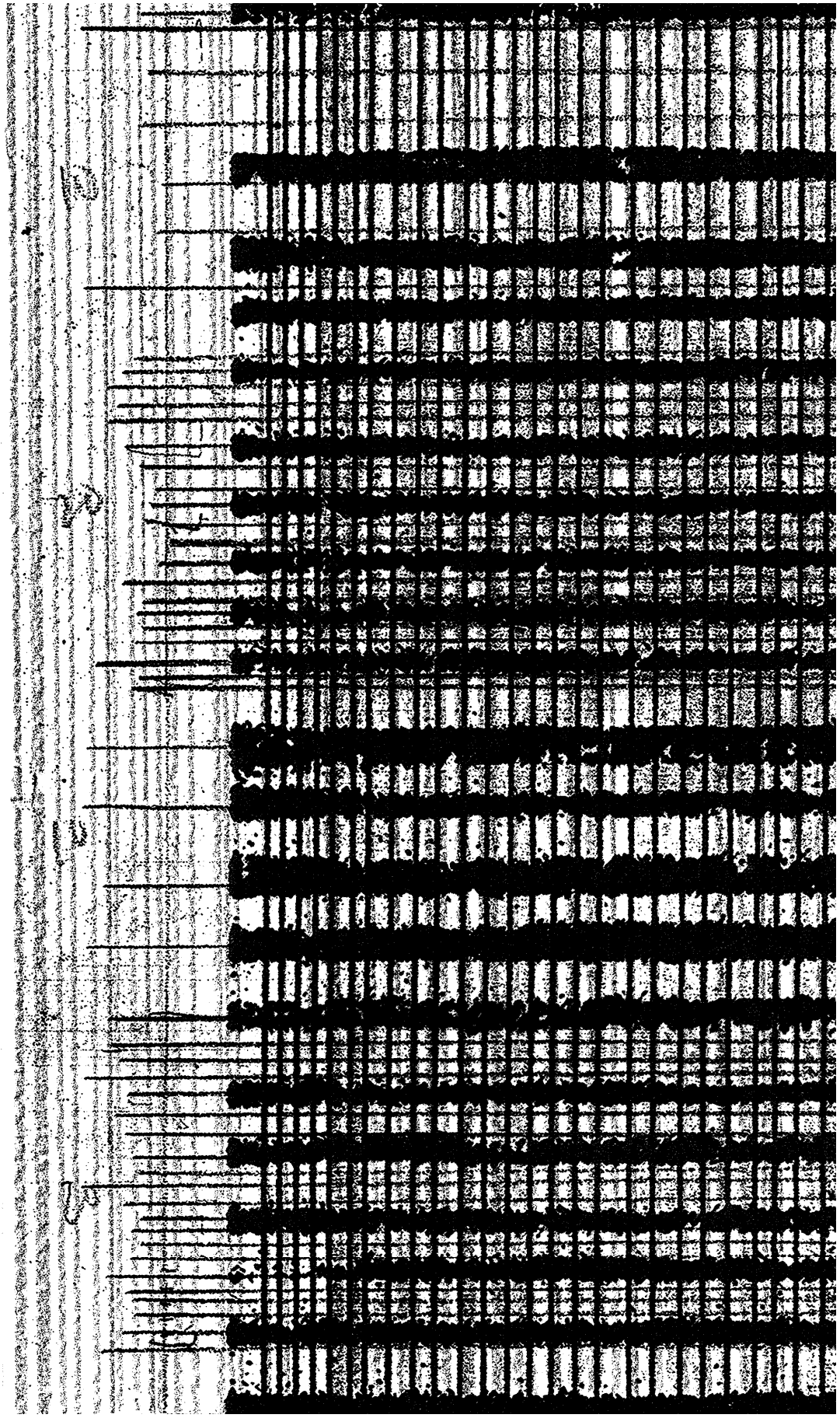

Figure 116: Final hatching study, detail (1).

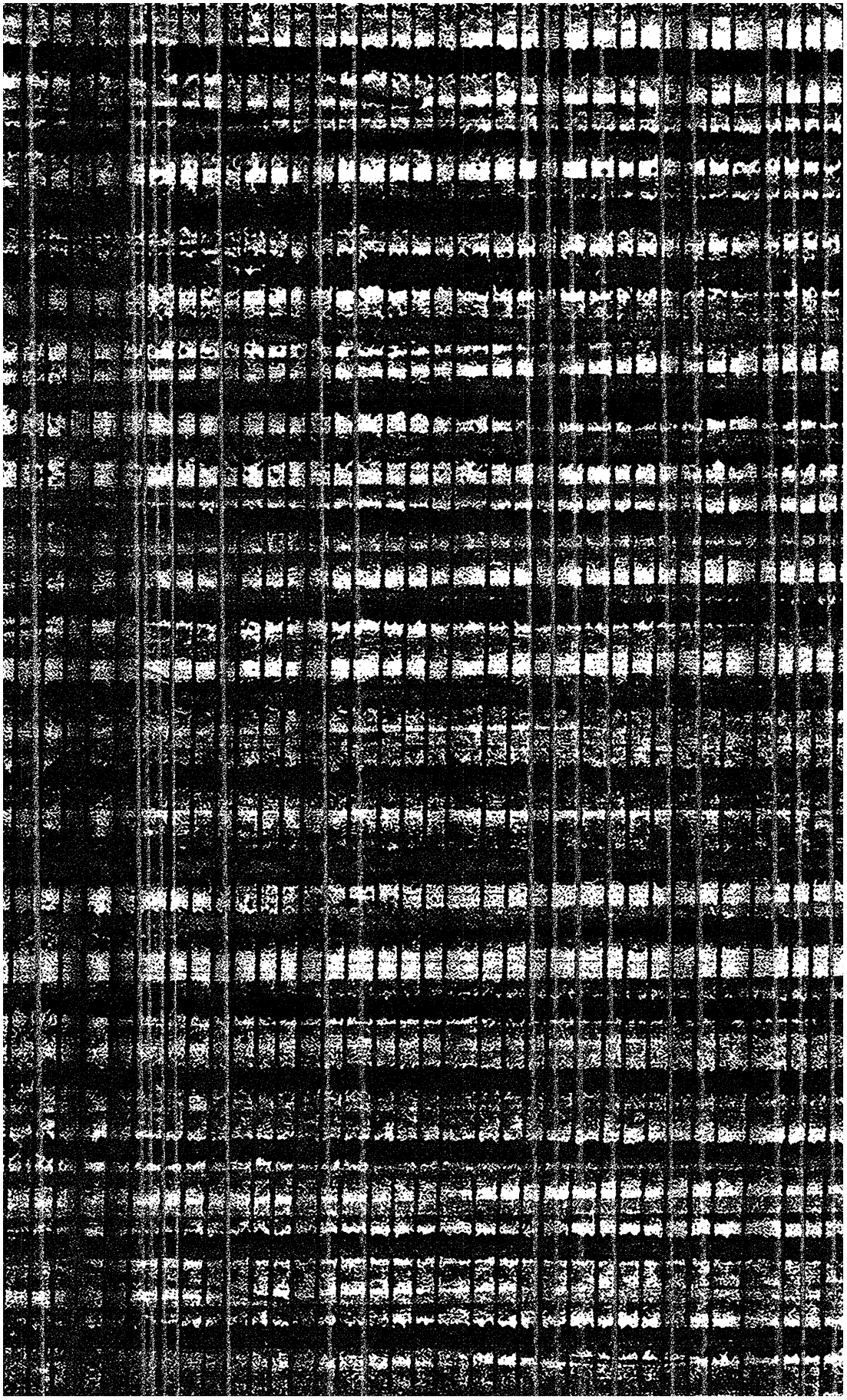

Figure 117: Final hatching study, detail (2).

4.2.3 Study (2): Disalignment

In the second of these two studies I have returned to some of the compositional strategies of previous drawings. I have identified aspects that are relevant to our being part of the world in that they are ambiguous or uncertain. I have emulated these, beginning with a simplified abstract study (Figure 118, Figure 119) and then making more elaborate drawings in which I have gradually developed these compositions to be more spatial. These drawings are much more figurative than the hatching experiments discussed in the previous section and the latter ones can be read as collections of layered elements shown in orthogonal projection (especially Figure 124-Figure 131). However they are, similarly to the hatching studies, intended to be read only as drawings rather than as proposals, albeit as drawings that might be read as if proposing something.

The first part of the study comprises a set of simple exercises using a photocopier which emulated an aspect of the Contingency project drawings in a more abstracted way and which was, similarly to the hatching study, based on a repetitive action made with minor differences each time. Taking a rectangle drawn on a piece of tracing paper, I first photocopied this, then placed the tracing paper over the copy at an angle, copied this and repeated this exercise 20 times, accumulating 20 overlapping rectangles. This quickly generated an ambiguous series of forms (Figure 118, Figure 119). The flattening of the photocopier merged the various positions of the rectangle together so that the differences in position created an ambiguous and tentative edge in a similar way to how I combined various versions of an element together in the Contingency project drawings.

I used these quick studies as a basis for further drawings. In these I was particularly interested in the tension between the alignment and disalignment of their elements, which is another instance of both pattern and difference and also of an oscillation between the order of the whole and the qualities of their individual parts. In these next drawings, which were made as overlays on each other, I have tried to develop these qualities in a more spatial way. This began by adding simple layers of hatching, emphasising some of these different alignments (Figure 121-Figure 123). As this series of overlaid drawings progressed (Figure 124-Figure 131), I reinterpreted what

had been overlaps between layers of hatching as overlaps of figurative elements, similar to the composition of some of the Contingency project drawings (for instance Figure 4, Figure 11).

Similarly to the hatching studies, the lack of bounding elements and the overlaying and overlapping of different layers give the drawings an edgeless quality such that, considered as spaces, the boundaries between one area and the next are indistinct. There is a tension between seeing the whole as an ambiguous field in this way and concentrating on any one of the elements which constitute this pattern. What I find interesting in this is that while the various alignments and repetitions set up different ways of explaining the ordering of the geometries and patterns in the drawings, none of these explanations fit the composition as a whole. These geometries are ones that need a variety of explanations for their different qualities and features. This is not to say that their irregularities make them more arbitrary than more regular compositions (every form we draw is arbitrary in the sense that it did not need to be drawn like this and non-arbitrary in the sense that we have chosen to draw it like this) but that explaining them is less efficient as there is no one way to explain their patterns as a whole. This is different from them being inexplicable or random as these are actually efficient explanations that fit the whole. Rather, that I need to give several rather than just one explanation means that I am more involved in the act of explaining and the undecidability of my choice of explanation becomes more noticeable. While I do not regard these drawings as making architectural proposals, this strategy could equally be applied to architectural compositions and this, it seems to me, is one possibility for an architecture that supports our formation of the sort of epistemological space of being part of the world which I have suggested above.

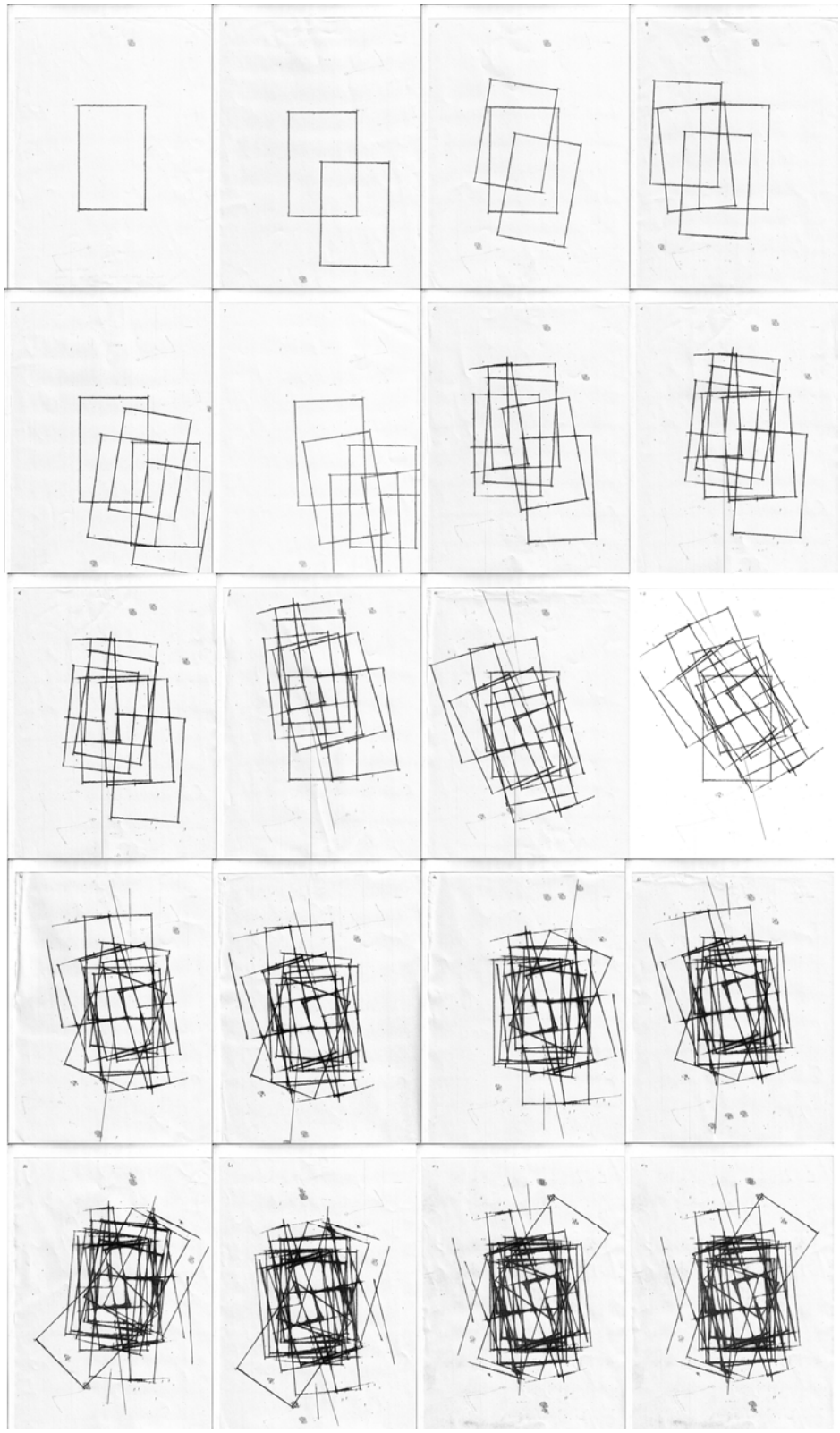

Figure 118: 20 rectangles study.
I started with one rectangle on a piece of tracing paper and photocopied this. I then placed the copy at an angle behind the tracing paper with the original rectangle and photocopied this again. Repeating this 20 times produced these ambiguous forms from only the repetitive overlapping of the one simple shape. As, in this version, I always placed the tracing paper squarely on the copier and the latest copy at an angle, the rectangle which is added in each copy is always in the centre of the page and the rest of the composition rotates around it, depending on how I placed the paper. I made several versions with different proportions of initial rectangle and slight variations in copying procedure. This, the first, is the most interesting and the one I used as the basis for the next drawings.

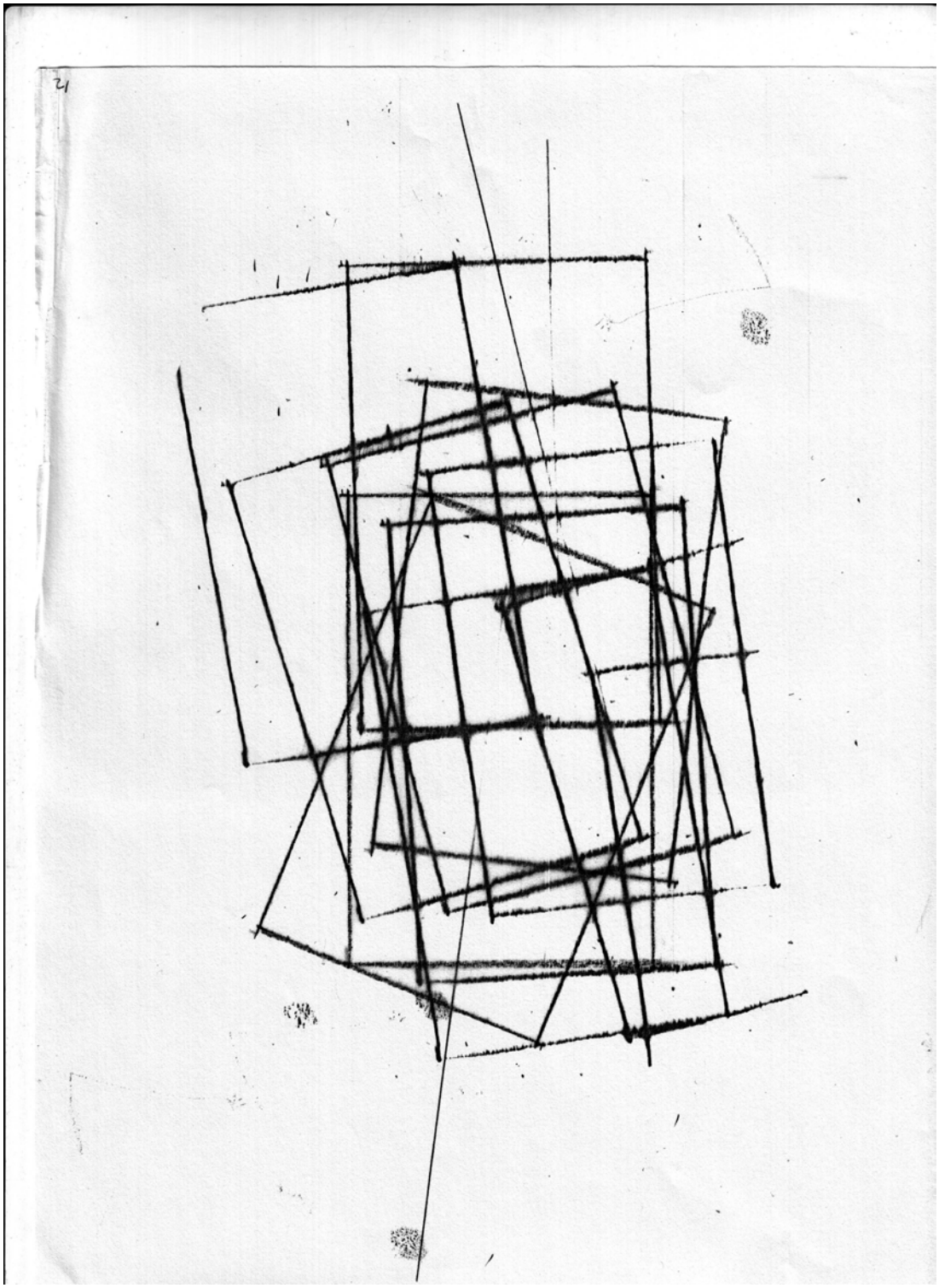

Figure 119: 20 rectangles, number 12.

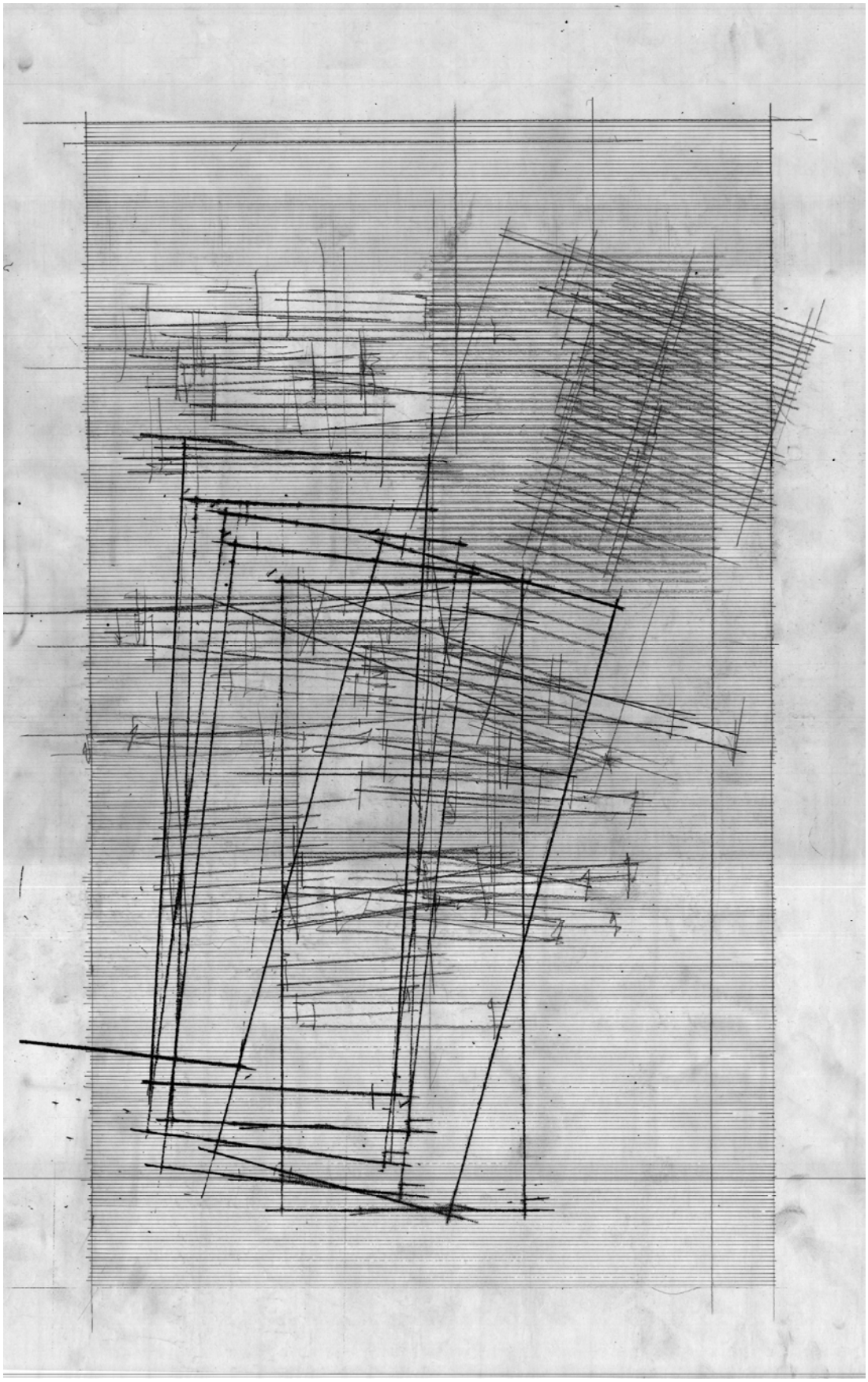

Figure 120: Disalignment study (1).

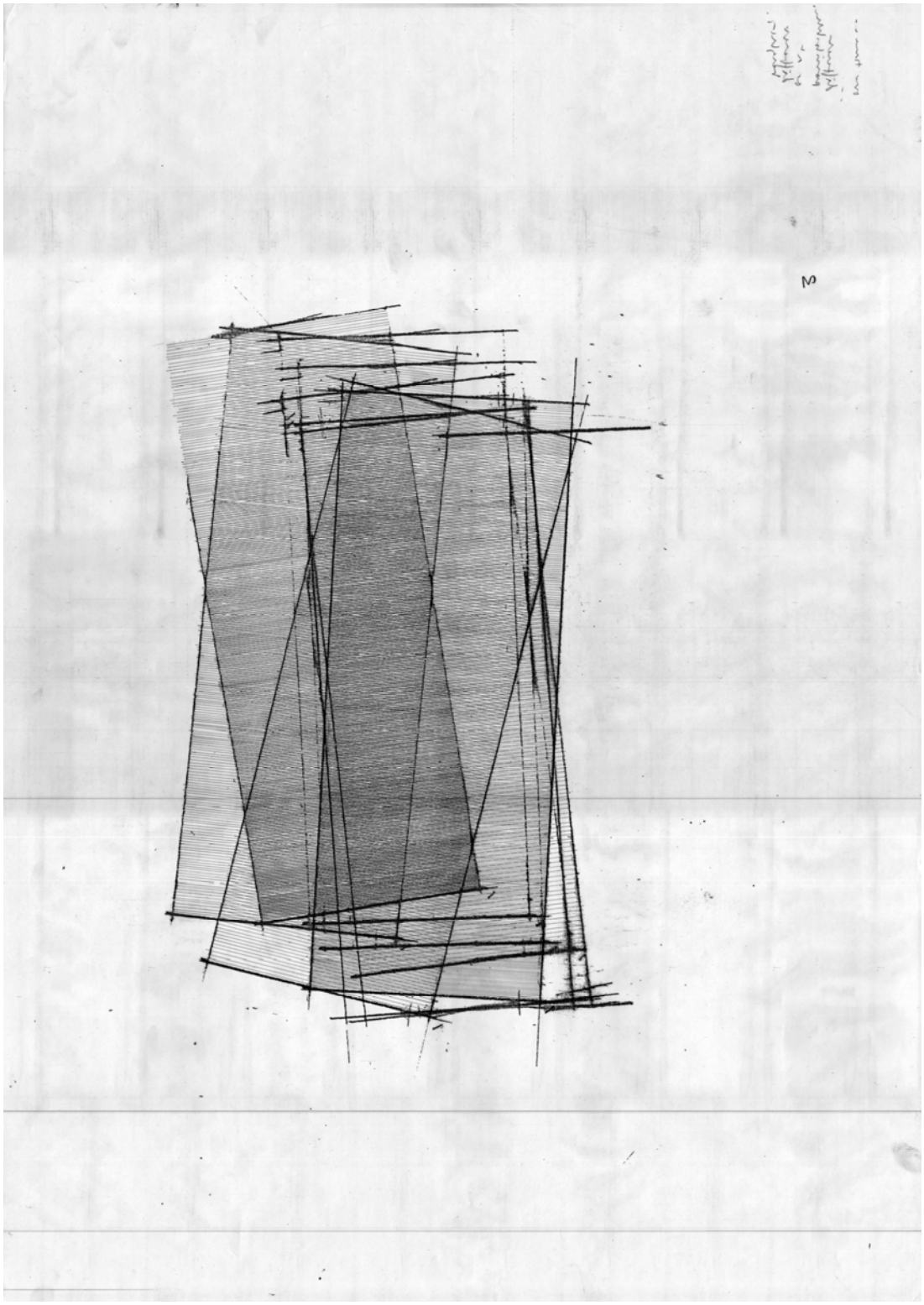

Figure 121: Disalignment study (2), ambiguous edges, overlapping lines.

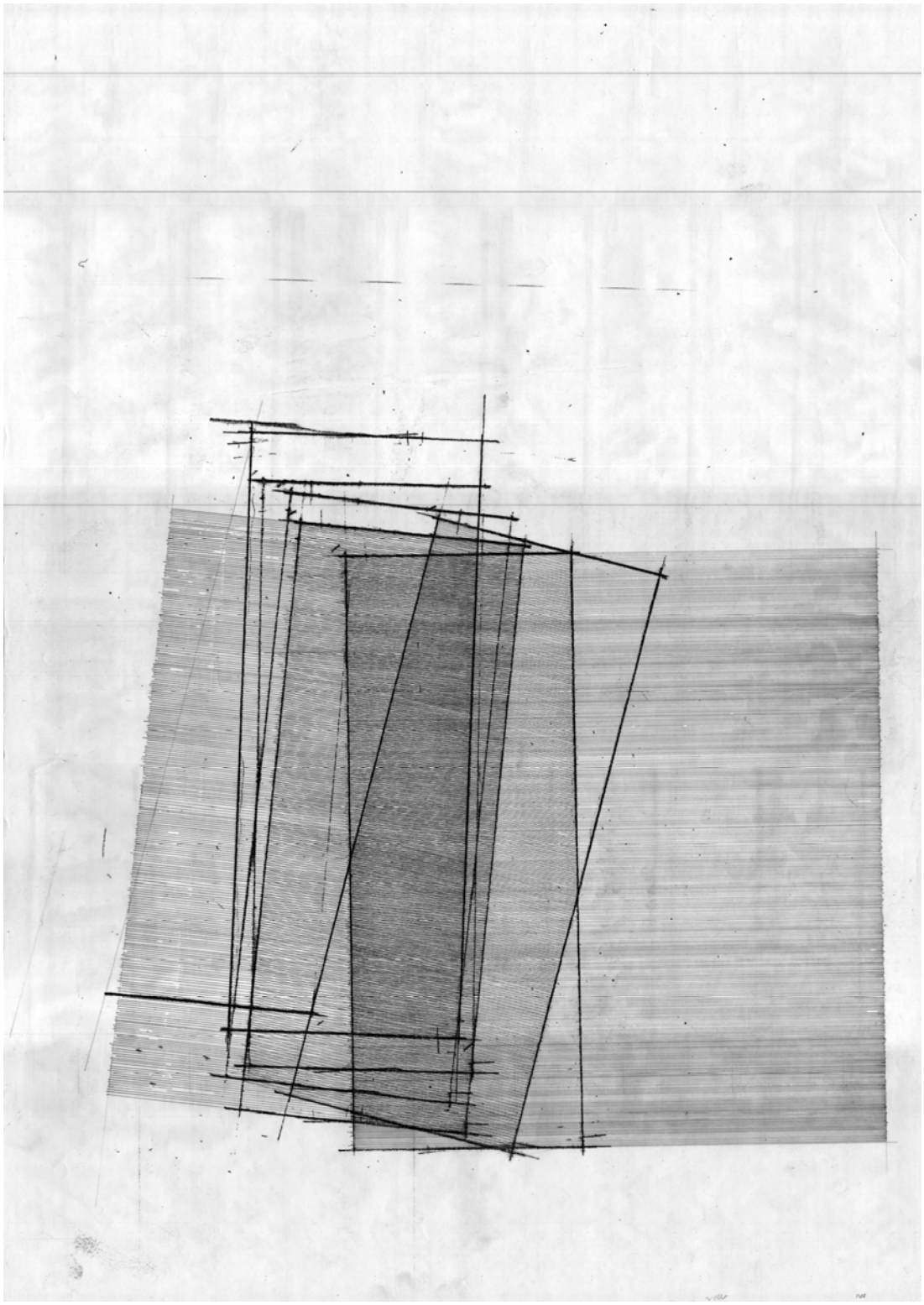

Figure 122: Disalignment study (3), ambiguous edges, overlapping lines.

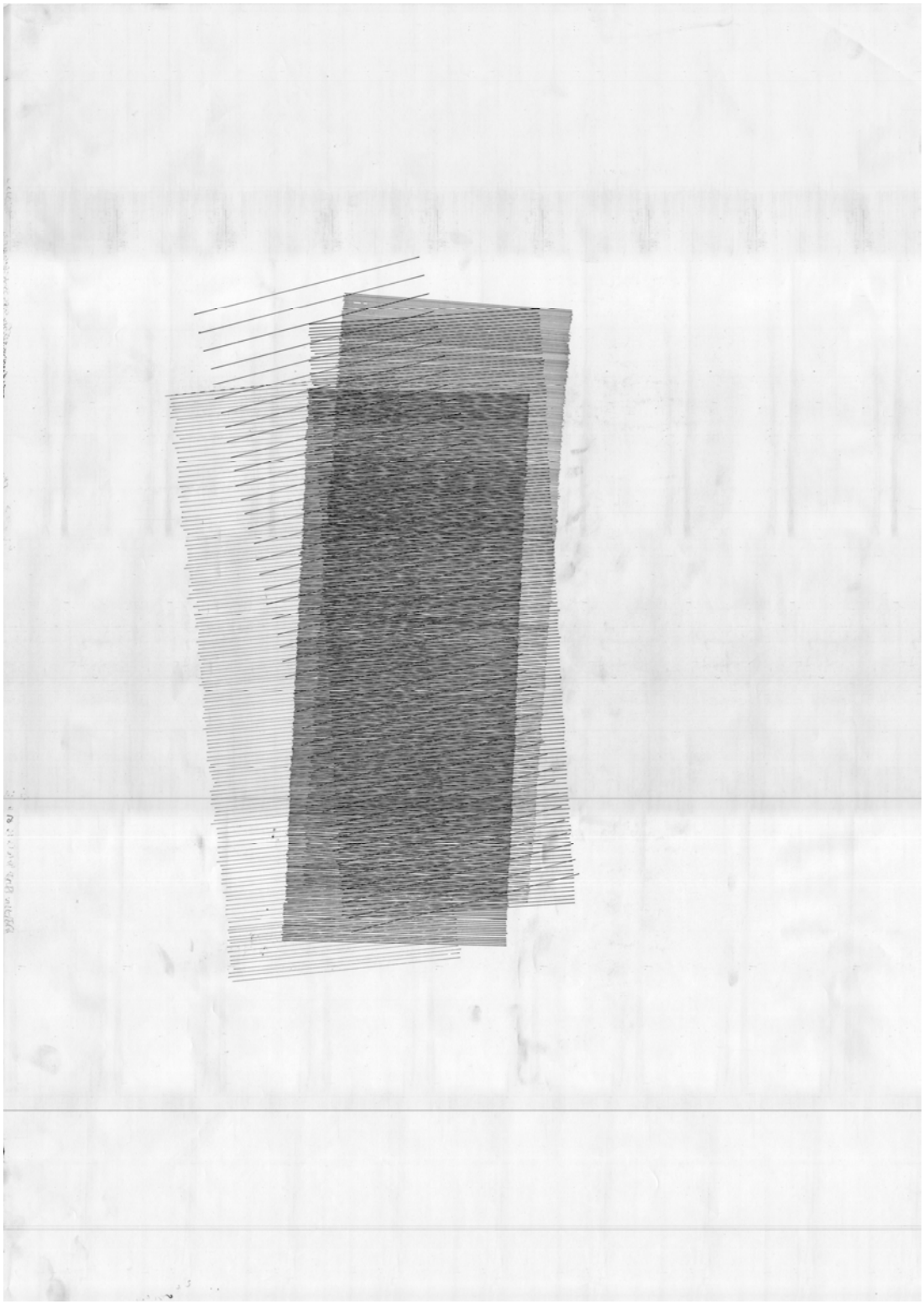

Figure 123: Disalignment study (4), overlapping lines.

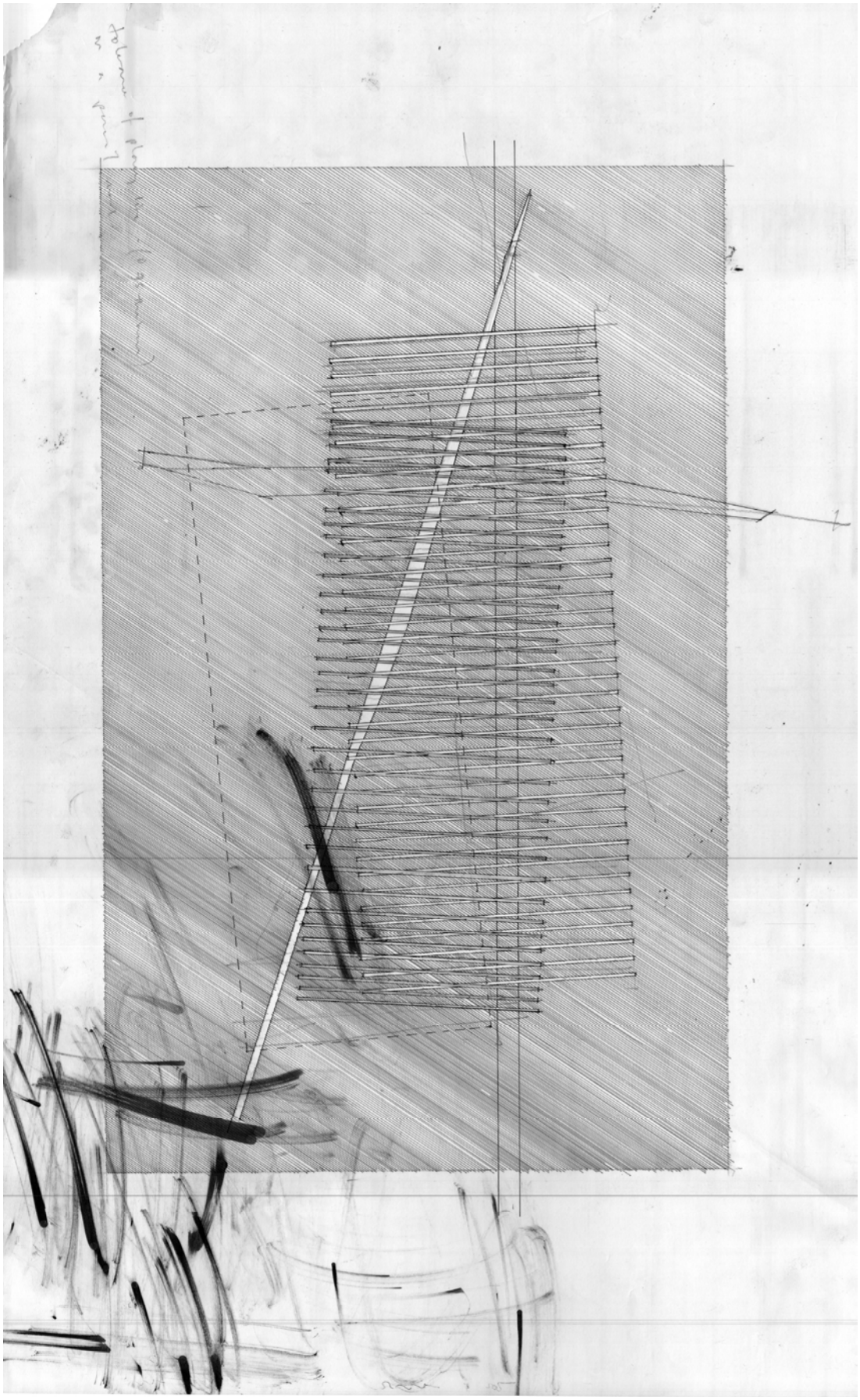

Figure 124: Disalignment study (5), overlapping elements.

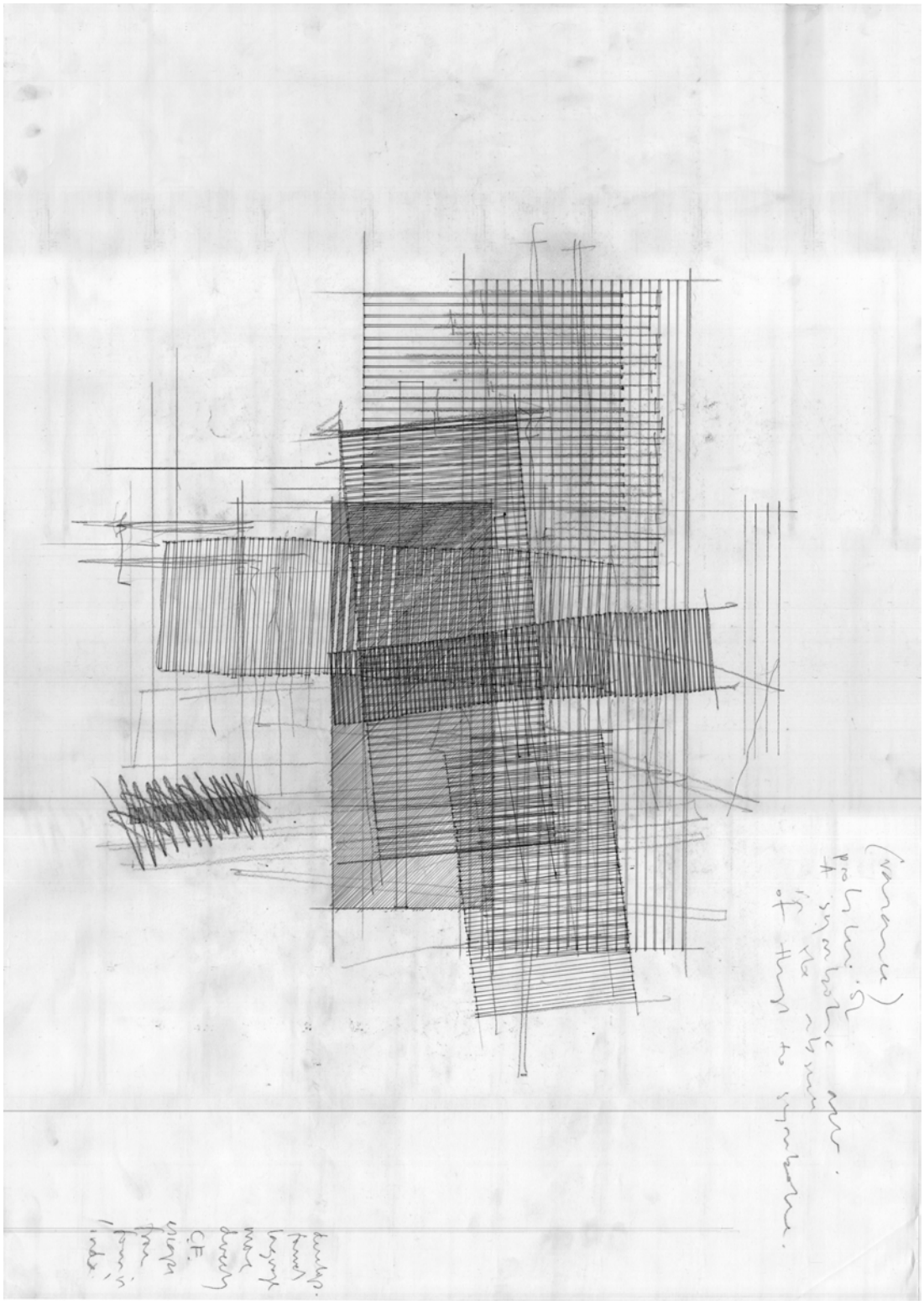

Figure 125: Disalignment study (6), overlapping elements.

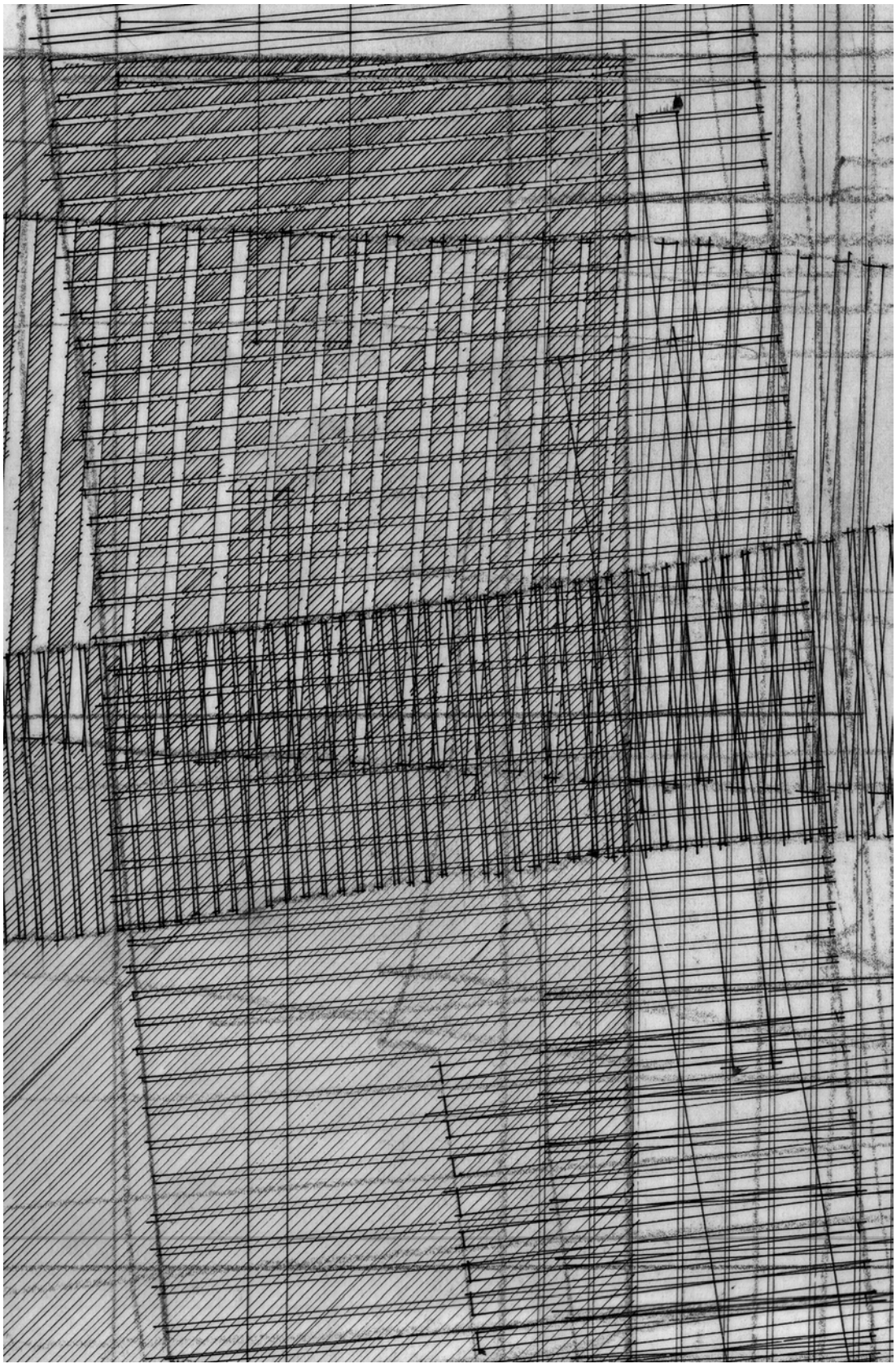

Figure 126: Disalignment study (6), detail.

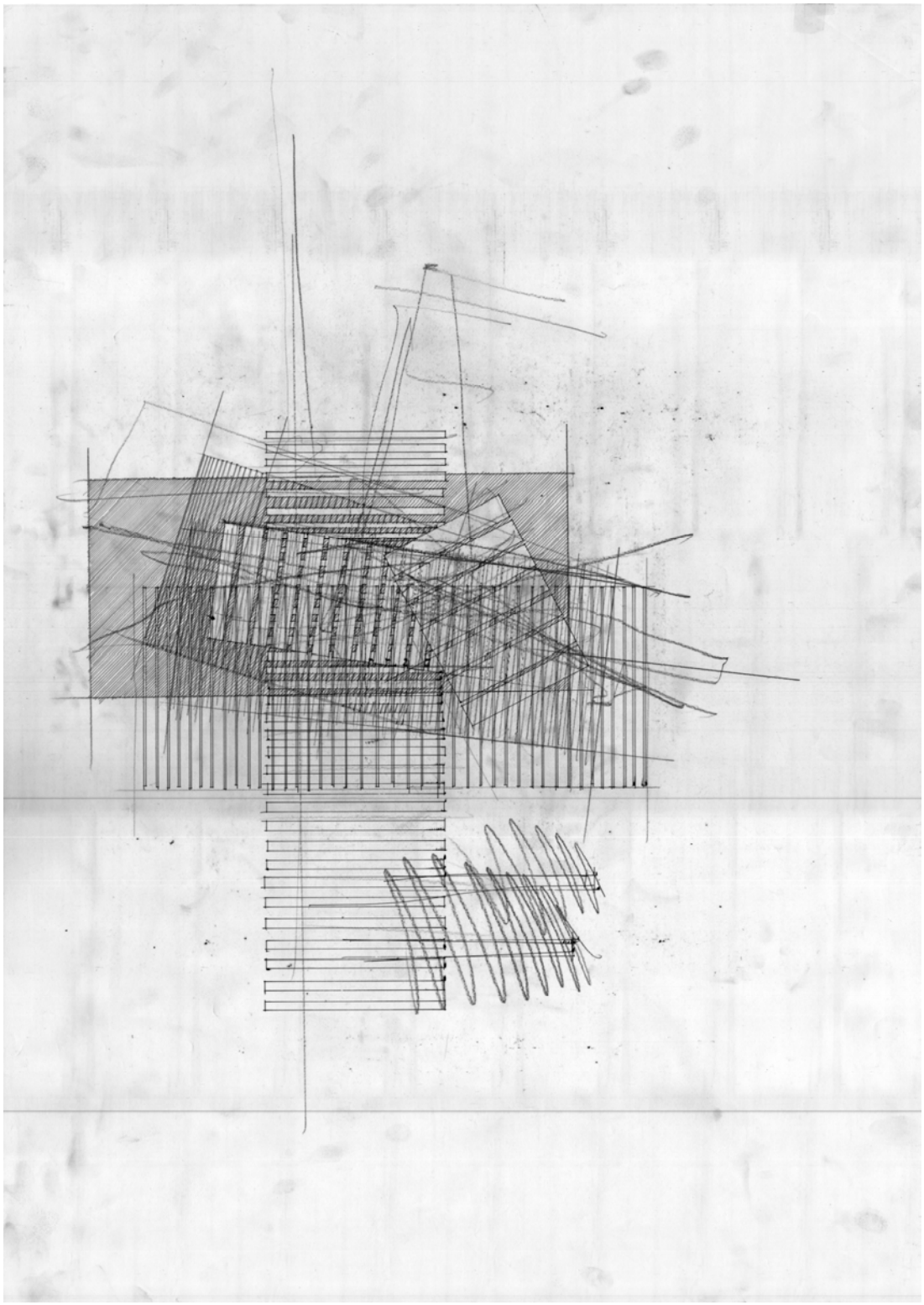

Figure 127: Disalignment study (7), overlapping elements.

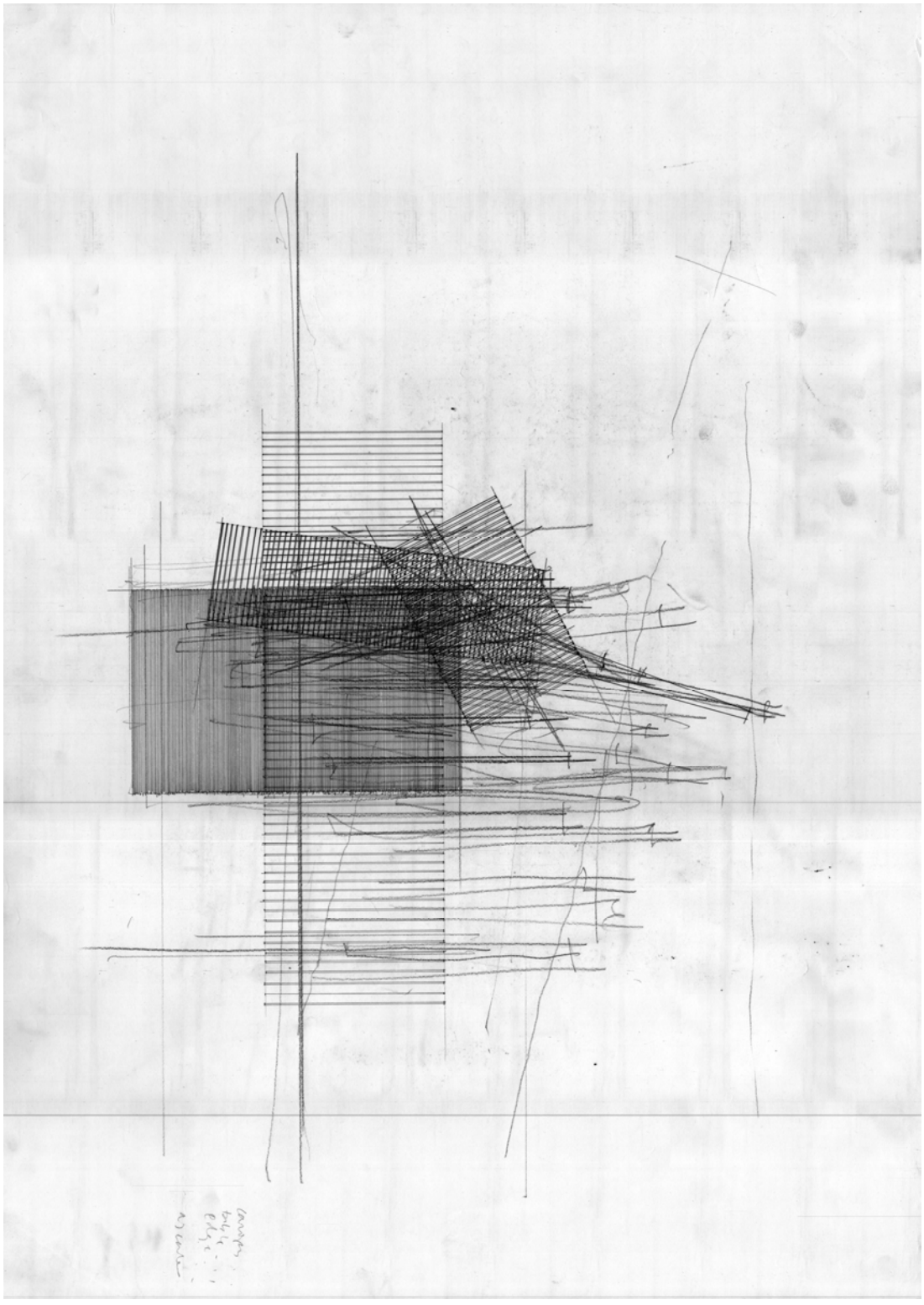

Figure 128: Disalignment study (8), overlapping lines and elements.

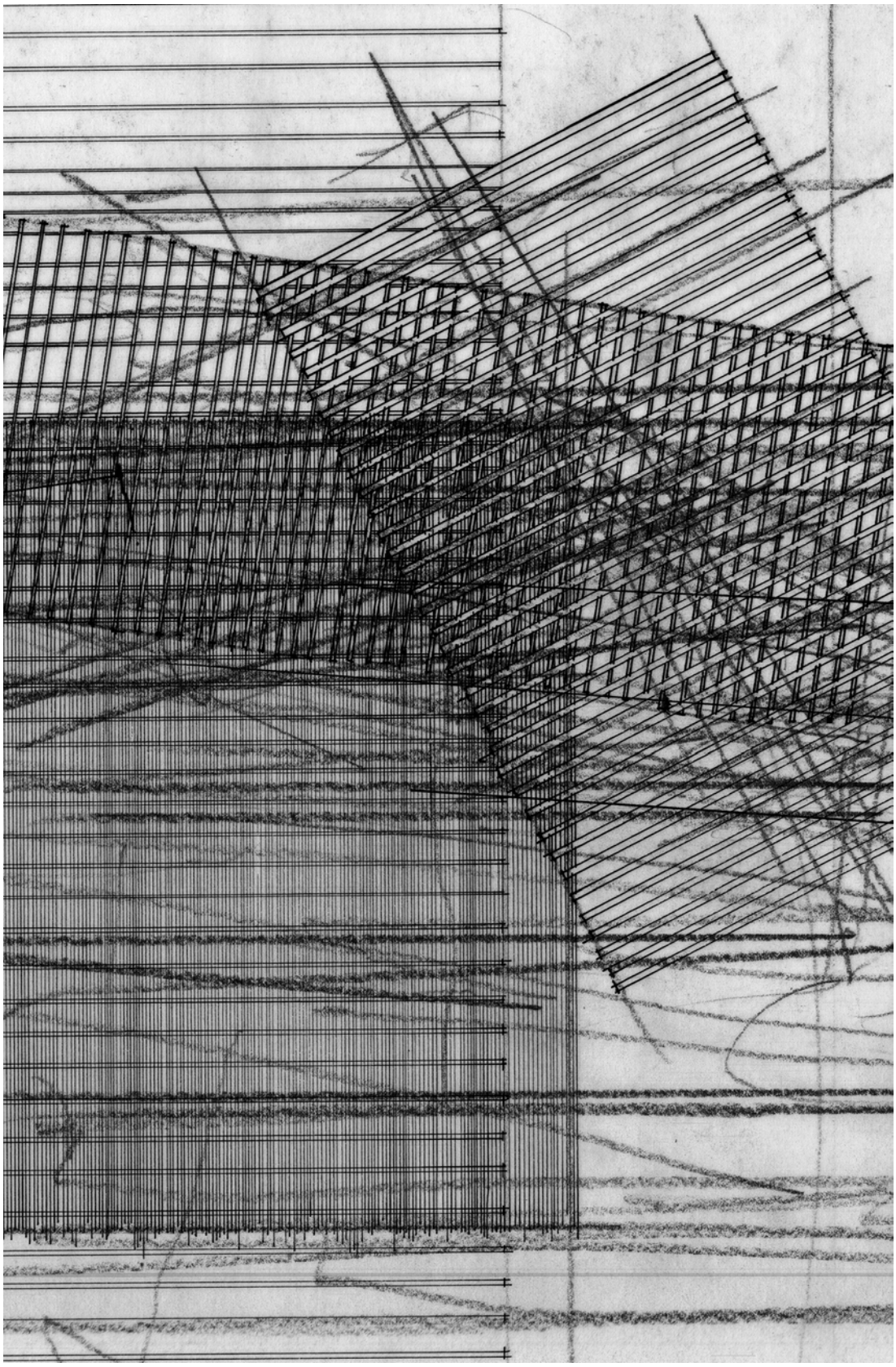

Figure 129: Disalignment study (8), detail.

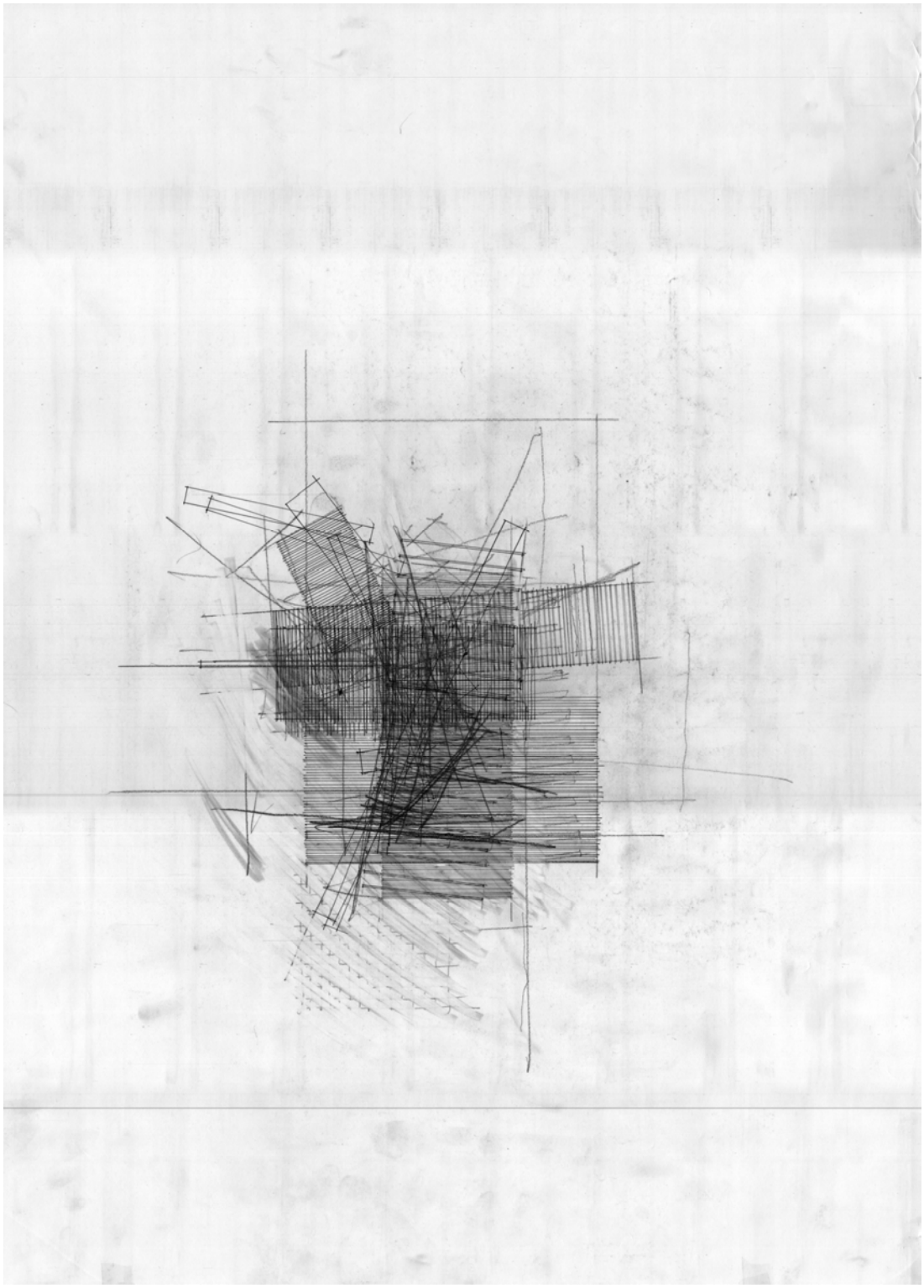

Figure 130: Disalignment study (9), overlapping lines and elements.

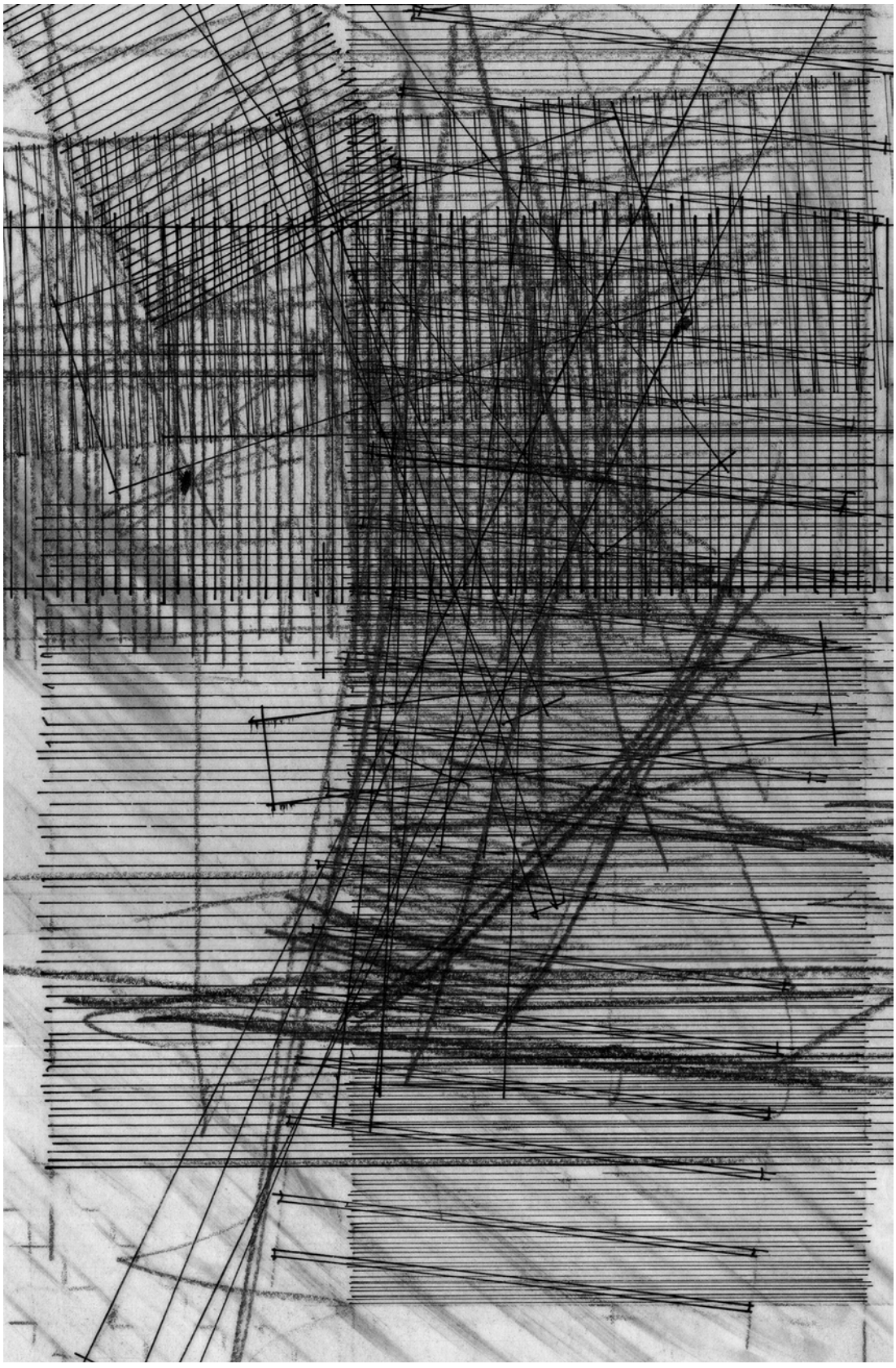

Figure 131: Disalignment study (9), detail.

4.2.4 Epistemological theatre

The provisional title I have given to this nascent project is Epistemological Theatre—by which I mean theatre in the sense of theatricality and of a space in which something happens (such as a "theatre of war"), rather than a building.[227] By epistemological theatre I therefore mean to propose a space which prompts epistemological questioning; that is, a space in which we try to understand or question our understanding and our relation to the world we observe. I have come to this title and the reference to theatre only after making the drawings presented above as one way of making sense of them. I have therefore not yet fully explored the richness of possible references that this opens up for investigation but point here to the connections which seem most relevant. While this is partly a reference to Pickering (2010) calling the physical cybernetic experimentation of Pask and Grey Walter "ontological theatre" (p. 17), I primarily have in mind the tradition of memory theatres and the art of memory as described by Yates (1966/1984). This tradition is notably referenced by Libeskind in his Three Lessons in Architecture project at the 1985 Venice Architecture Biennale and his (1985) *Theatrum Mundi* drawings (see also Ioannidou, 2010; Spiller, 2006, pp. 152-157). One of the ways in which it is possible to interpret his earlier Micromegas drawings (Libeskind, 1981, pp. 79-103), which are one influence on some of the most recent drawings I have made, is similarly as a memory theatre of architectural geometries and projections. The connection between theatre and cosmology proposed by Vitruvius (V.vi.1), who associates the theatre with cosmic proportions, and which has been explored by Yates (1969), is also relevant given my discussion, drawing on Bateson, of ecology and epistemology in terms of the cosmological tradition.

Given the understanding of epistemology I have set out above, following von Glasersfeld (1990a, p. 19), as concerning knowing rather than knowledge, what I am aiming at here is however in contrast with the art of memory. Whether through using existing structures or purpose built devices, the art of memory was based on establishing correspondences between knowledge, to be remembered, and physical forms, with which to remember them. The idea of a memory theatre

[227] The etymology of theatre, from the Greek *theatron*, connects it to viewing and so with the theme of epistemology.

therefore implies a fixed set of knowledge about the world to be learnt. In contrast to this, while I am still interested in communicating the idea that we are part of the world, I wish to avoid doing so directly in terms of representing this idea as this, in my previous attempts, has sometimes implied realism and so being apart from the world (see above section 3.2.4). Instead, my current thinking is to attempt this communication implicitly through observers becoming aware of their own epistemological connection to their surroundings (in a similar way to my discussion of Light Well; section 4.1.2) and in this way to prompt epistemological questioning. The guiding principle for the theatre of this project is therefore not to propose a device for remembering but for thinking and for questioning thinking.

4.3 Conclusions

4.3.1 Summary

I began this thesis by considering those situations in designing architecture, epistemology and ethics which have no right answers—which are undecidable, wicked or otherwise irresolvable. In each of these three contexts I have interpreted this in terms of there not being a correspondence to be made: that knowledge is not a correspondence with the world beyond our experience; that ethics is not a matter of defining and conforming to moral codes; and that design cannot be successfully codified in deterministic rules or reduced to processes such as optimisation. In developing this I have drawn on accounts of epistemology from design research, second-order cybernetics and radical constructivism. In particular I have used von Foerster's formulation of the epistemological question of realism and idealism, as the undecidable choice between whether we are part of the world or apart from it, as a way of interlacing epistemological, ethical and spatial ideas.

My account has for the most part comprised two parallel strands. In the first (Part II), beginning from the epistemological and ethical senses of our being part of the world, I have used the way that a cybernetic understanding of epistemology has parallels with both ethical questions and also the methodology of the design process to suggest connections between design and ethics. In particular, I have suggested some ways in which the expertise which designers demonstrate with wicked problems is of relevance to ethics in its concern with dilemmas (and at least with those wicked problems that are ethical in character). I've examined some of the ways in which designers approach such situations, understanding design as a way of acting in which ethical considerations are implicit in that they are integral to designing even when not explicitly raised in the context.

In the second strand (Part III) I have been concerned with the spatial experience of being part of the world and how this might be expressed architecturally. I've pursued this in various design projects which take their starting points from aspects of the world where I find my own experience of this to be heightened, such as where our bodily presence in a place leaves traces behind, the

typicality of everyday situations and where those spatial qualities which I take to be common to us all are particularly manifest.

These projects have raised questions about ethics and epistemology which intersect with issues from my account in Part II. In Part IV (so far) I have reflected on these intersections as a way of bringing the two parallel strands of my argument to a joint conclusion. This has led to me revising or developing aspects of my initial account of our being part of the world:

1. I have expanded on my earlier discussion of the role of drawings and models in design as supporting the conversational epistemology of designing. Drawings and models allow designers to model not only what it is that they propose but also the epistemology of how what they propose will be experienced. This is one aspect of how designers use drawings and models to see through the eyes of others and of how the function of drawing is not just epistemological but also ethical.

2. I have refined the spatial sense of the idea that we are part of the world in a distinctively cybernetic way, understanding it as the epistemological space of observing one's own observation. In this I have found a way to disentangle these spatial concerns from the implications of realism that lingered in some of my earlier projects and in understanding architecture in terms of phenomenology.

3. I have returned to the parallel between architecture and ethics and traced this in part to the self-reference that, as well as what is proposed in designing architecture and in speaking about ethics, the ways that such propositions are developed and presented are themselves ethical matters. Part of the significance of design being a way of acting in which ethical questioning is implicit is that it allows this sort of self-referential ethical question to be considered.

In response to these ideas I have presented the beginning of a new design investigation as a way of moving forward by exploring these revised understandings of our being part of the world. I have presented two initial studies which developed spatial themes from analysing aspects of my previous drawings. This investigation builds on the ways in which the understandings I have developed have led to new insights for me about my own work. I have, for instance, found the limits

of some of my former approaches (where, for instance, they have tended to imply realism) and developed ways to value my work, and especially the drawings, in a richer way which accommodates both theory and practice.

4.3.2 The significance of this thesis to cybernetics, design research, ethics and architecture

The significance of this thesis is partly personal, in that it has enabled me to move my design work forward in a way that is different from my previous investigations, and partly general, in that it makes a series of contributions to the different contexts with which I have been concerned. Part of this general significance has been where I have established points of connection across these different areas (such as between the spatial, epistemological and ethical senses of being part of the world with which I began) as well as the more specific interrelations that I have explored. My work also has relevance within each of these contexts—cybernetics and radical constructivism, design research, ethics and architecture—individually. I have summarised the main contributions that my thesis makes in each of these areas below.

4.3.2.1 Contribution to cybernetics and radical constructivism

Cybernetics and radical constructivism have been significant influences on the direction of my research. I have drawn on their understanding of epistemology as a point of departure and have used the relations between cybernetics and design and between cybernetics and ethics as major points in my argument. In doing this I have explored some of the consequences of holding a cybernetic and radically constructivist position and so have contributed to our understanding of what such a position entails and makes possible. In so doing, I have provided an argument for the continuing relevance of these ideas.

My work has also tested the analogies between cybernetics and both ethics and design on which I have drawn. I have strengthened these by extending them and by developing a way of bringing them into relation with each other. While I have drawn on existing accounts of the relation between cybernetics and ethics (and especially that of von Foerster) I have elaborated on these

substantially. In particular I have used the example of designing architecture, where the epistemology of cybernetics is embedded in an ethically complex situation, in order to discuss the relation between this epistemology and ethical questions more directly, while still holding to von Foerster's "ethics cannot be articulated" point. Through this I have challenged the reticence that is sometimes assumed to be implied by von Foerster's ethical position, both in terms of our action towards others and our discussion of ethics, which I believe to be misplaced. What I have proposed is, by contrast, more involved and less neutral, while still retaining the important quality of undecidability. By connecting the analogies between cybernetics and design and cybernetics and ethics together, I have understood design as an example of how the understanding of ethics in cybernetics can be put into practice—that is, of how we might practice ethics without moralising and without merely resorting to the sort of reticence which is equally problematic.

These observations about the connections between cybernetics, ethics and design reflect back onto cybernetics itself and the relation between it and practice. Cybernetics is concerned with explaining actions which involve circular feedback. Its concepts help us to understand how to act in such ways and the value of doing so in particular circumstances (for instance, the importance of dialogue in design). However, there is no strict division between some ways of acting which "are" cybernetic and some which are not. Cybernetics leaves open the possibility of other different explanations being equally viable (such as where radical constructivism insists on its own undecidability) and even linear processes can be explained in cybernetic terms (for instance, one can understand coding as a special case of conversation; Glanville, 2004b, p. 1382) and will have contexts where they are valuable (for instance, while dialogue, with its degree of ambiguity, is crucial in designing a building, unambiguous coded communication still has value in communicating construction information in a building specification). That we can explain the same actions in different ways does not, however, mean that the relationship between cybernetic explanations and the actions they explain is a neutral one. For instance, while we can choose to explain the same action in terms of its goal being intrinsic or extrinsic to it and whether we have included ourselves in it or not, this different explanation results in us locating value (goods, goals) and responsibility differently in relation to our actions. As can be seen from considering the examples of designing

architecture (see above section 2.1) and teleological accounts of ethics (see above section 2.2.3), explaining our actions in different ways can lead to markedly different ways of acting. This is an example of the sort of cybernetic circularity, so evident in design, where we take how we understand what we have done as the basis for how we continue to act and so where our actions are interdependent with how we explain them. The relation of cybernetics to practice is therefore not just that cybernetic theory might usefully guide our actions but that, in a more general sense, we understand our theorising as a constituent part of our practice.

4.3.2.2 Contribution to design research

Within the context of design research, my work complements the idea that design has its own epistemological foundations, rather than needing to be underpinned by that of science, by proposing a way in which it is also possible to speak about ethics in design's own terms rather than by importing external theory. I have developed this by recognising the similarity between the structure of ethical dilemmas and the wicked problems with which designers are often concerned. Given this, I have proposed ways in which the conversational structure of designing can be understood as implicitly responding to the ethical questions involved in design, such as the asymmetrical relationship between designers and those they design for.

The principle consequences of this are for how we go about discussing ethics in relation to architecture and design. If we see the sort of ethical questions which arise in designing as special cases of wicked problems (and, indeed, the complexities of wicked problems as arising because of their involvement of others and so of ethical questions) then it does not make sense to approach them by trying to find right answers to which our actions should conform, nor to understand the relation between ethics and design in terms of the application of given ethical theory to practice. I have instead proposed that design's core conversational methodology implicitly involves ethical questioning, and especially the consideration of others, in a way which is appropriate to the sorts of ethically complex situations that designers encounter in practice. This implies that where we discuss the ethics of architecture and design, we shift from attempting to evaluate whether some particular architectural approach or design method is or is not an ethically good one, which in the case of

wicked problems is impossible to resolve, to whether we are designing in a way which has made it possible to consider ethical questions as part of our action. This does not mean that the more explicit ethical questions that we encounter in designing architecture need not be considered. Indeed these questions are what drive the implicit questioning which I am highlighting and these two sorts of questioning are complementary. However, where we treat the sort of ethical questions that arise in design as being tamely resolvable or as matters that can be settled in advance, we obscure the nature of these questions and obfuscate our responsibility for them. In order to fully consider the sorts of complex ethical questions that arise in designing architecture, we need to question not just the issues at hand but also our questioning of these issues as part of what is at stake ethically.

This makes a difference not just to discussions of the ethics of architecture and design but also to design education and design practice more generally. In design education, this does not imply a radically different pedagogy but, rather, reinforces the value of the conversational model (as in Schön's (1983/1991, pp. 79-104) example) at a time when it is under threat in the current context of higher education, with increasing pressure on teaching budgets and class sizes. The value of this form of design education is not just because of the generally applicable pedagogic benefits of conversational feedback but, also, because it is a way in which design (understood as a conversation) can be demonstrated and experienced through being acted out with others. As well as being a way of learning and teaching which is integrated with, and a demonstration of, design's core methodology, these conversations are also a form of preparation for the more ethically complex dialogues with others that students will go on to have in design practice. In doing this, the value of the way that tutors often play the role of multiple others (peer, client, consultant, user, planner and so on) is not just in bringing these views to bear on the project at hand but also to help the student to learn to anticipate such others in their thinking.

However, that understanding design as a conversation reinforces the value of the conversational model of design education does not mean that this tradition should necessarily go unchallenged but that it is its dialogical structure that is the most important aspect of it and of any proposed alternative. The weaknesses of some common tendencies in design education, such as the

"entertainer" and the "hegemonic overlord" criticised by Webster (2004, p. 108), drawing on McLaren (1986/1999, pp. 113-119), follow from their monological structure despite the still apparently conversational manner of their setting.[228] The paradigmatic status of Webster's contrasting example of the "liminal servant" (McLaren, 1986/1999, pp. 114-119; Webster, 2004, p. 109) follows from its conversational nature and concern for seeing through the eyes of others. The way that this conversational feedback is often achieved in design education is not just through the sort of one on one tutorial which Schön takes as an example but also through students' conversations with their peers, whether through working in a shared studio space or in formal peer review sessions. In these sorts of conversations students have the opportunity to reflect on a project that is not their own and which is motivated by someone else's desires and criteria, an activity which anticipates important practical and ethical aspects of designing for others.

The significance of my argument for design practice, similarly to its significance for teaching and learning, is not a radical departure from current methodologies but a reaffirmation of the value of the conversational structure of designing as being of not just epistemological but also ethical importance. This leads to an understanding of ethics as an integrated part of the design process rather than an add-on or external limitation to it, as it is sometimes regarded (see above section 2.1.3). Where this stands in contrast to contemporary design practice, and so appears to be radical, is where the practice of design has become detached from the discipline of design and its conversational structure. These observations are of particular relevance given recent developments in computing technology, such as parametric design and building information modelling, and emphasise the importance of integrating such technologies into the design process (in the sort of designer-machine dialogue explored by Negroponte) rather than using them to automate it.

4.3.2.3 Contribution to ethics

By recognising the similarity between the structure of the wicked problems that designers commonly encounter and those dilemmas with which ethics is often concerned, I have argued that

[228] See also Webster's (2008) comments on Schön's Quist and Petra case study.

the way that designers approach such situations is relevant not just to the ethical questions that arise in the context of architecture and design but also to ethics more generally. In this way I have inverted the conventional relationship between design and ethics, where already established ethical theories are applied to problems in architecture and design (this being one aspect of the idea that design is a meta-discipline). I have proposed that design be understood as an example of how to act in the sorts of complex situations where conventional (deontological, consequentialist) ethical reasoning results only in irresolvable choices between incommensurable theories of what is good. Understanding these situations in this way shifts the focus of ethics from trying to discern what is the "right" thing to do, which in the case of wicked problems cannot ultimately be determined, to how we go about considering how we will choose to act (see section 4.1.3). This has similarities to other positions in ethics in whole or in part; I have noted particularly that of Eagleton and some of the more partial relations to aspects of virtue ethics and existentialism, while many others could also be mentioned. The significance of establishing this from an understanding of design is that I have been able, firstly, to substantiate the idea that considering there to be no right answer to an ethical question does not lead to ethical arbitrariness and, secondly, to suggest how this understanding of ethics might be practiced in even trying circumstances (such as wicked problems) whereas it otherwise (for instance, in Eagleton's (2007) account) appears rather idealistic.

The idea that we consider not just how to respond to ethical questions but also how we undertake this consideration provides a clear perspective on many of the ethical issues we currently face. Where we treat wicked problems, such as the environmental crisis or social questions, as being tamely answerable, we obscure the nature of these situations because we exclude ourselves from them. For instance, where we characterise the environmental challenges we face as solvable by technological means or other forms of instrumental reasoning, we end up perpetuating this crisis rather than solving it (Bateson, 1972/2000, pp. 496-501). Similarly, where we treat the sorts of social questions which were the original context of Rittel's (1972) wicked problems by trying to solve them as if they were tame, we forget that our actions form part of the situation we are acting in with the consequence that their effects are uncertain. Where we approach ethical questions with already

given ideas of what is “right”, such as a moral code to which we think others should conform, we obfuscate our responsibility for our ethics and the relations between us and others.

As Bateson (1972/2000) has noted in the context of the environmental crisis, “we should trust no policy decisions which emanate from persons who do not yet have that habit [to not separate me from you, us from our environment]” (p. 469). Similarly, I see the clarification that what is ethically at stake is not just what we do but also the way we consider what we will do as a precondition for approaching ethical questions in a way that does not degenerate into assertion and counter-assertion. While the certainty of moral codes and other forms of objectivity will always remain attractive, I have shown that, in the case of wicked problems, it is this certainty that is arbitrary. In contrast, the position I have set out is independent of how we choose to resolve undecidable meta-ethical questions (see above section 2.2.2.1) but instead follows from this undecidability and so makes claims on us which are generally applicable (although see section 4.3.3 below). It is by recognising that we cannot speak about ethics objectively that, conversely, we can understand ethics in a way which is not merely personal.

4.3.2.4 Contribution to architecture

In Parts III and IV of this thesis I have presented a series of design projects and other drawings. I have used these to investigate the spatial sense of the idea that we are part of the world and how our experience of this might be heightened architecturally. The majority of this work has been concerned with the marking of time in everyday situations in a way which makes visible the various transitory qualities of their occupation and so our presence in them.

While most of these projects involve mechanical components, and so can be thought of within the field of interactive or responsive architecture (and also the wider theme of architecture’s relation to machines; see above section 3.1.4.4), my primary concern has not been with this context. The automation I have proposed in the projects involves only straightforwardly linear translations and I have not set out to investigate the possibilities of more elaborate interactions (although I have been concerned with how observers might interact with the projects over time, as with any piece of architecture).

The main context of my design investigation is with the architectural theme of place and the way that architecture has sometimes been used to situate us within the world or within our understanding of it. Examples of this include the way that architecture is a built relation between us and our environment, and sometimes even a device for measuring it (such as, for example, the Pantheon in Rome), and also where we embody our understanding of the world in particular buildings.

The architectural theme of place is often associated with phenomenology, with authors such as Harries, Norberg-Schulz and Vesely drawing on Heidegger and related thinkers. There is a degree of conservatism to this tradition, following from interpreting place in terms of the specificity of particular locations and what I have described as the lingering realism of phenomenology generally (see above section 3.2.4). I have proposed an attitude to the theme of place that avoids the realism and conservatism of a phenomenological approach by shifting the emphasis from the observed to the observer and so from rootedness in particular locations to the inter-dependence of observers with the world they observe.

While this shift is exemplified by the way my work has moved from projects that investigated the qualities of particular sites (Part III) to more abstract investigations (Part IV), it is also present in the way I have developed my discussions of the earlier projects. For instance, I have understood the Allotment Calendar as not being merely concerned with the indexical representation of information but, rather, with the observation of one's own presence in and connection to the site that this indexing makes possible. The space of the Allotment Calendar is a space of observing one's own observation and so a place where the self-reference of epistemology (where one tries to understand how one understands) becomes spatially experienceable. The more abstracted studies of Part IV continue this investigation and can be summed up by the idea of "epistemological theatre" as a space in which we question how we understand the world, in contrast to a memory theatre, where we remember or recombine already established knowledge (see section 4.2.4). My studies so far live up to this aim only in part but do at least indicate a direction of travel for future work.

4.3.3 On the undecidability of this thesis

The last aspect on which I wish to reflect is the relation between the position that I have advocated, largely drawn from second-order cybernetics and radical constructivism, and the idea of undecidability that is part of it. Similarly to von Glasersfeld's (1984, p. 14; 1990a, p. 19) comments on radical constructivism, I do not wish to present my ideas or those of the others on whom I have drawn as if they are a true or best account. I understand the position that I have proposed as being a choice to act and to understand in this way. Other ways of acting and understanding, such as the various forms of realism which I have presented my account in opposition to, are also viable and the choice of one over another is undecidable, whether in terms of deciding between different explanatory principles or in returning to the undecidable question, with which I began, of the relation between our understanding and the world.

That such a choice between viable alternatives is undecidable does not mean that it does not matter which way it is resolved or that one cannot advocate one option over another. Often we understand such choices to be made on instrumental grounds—that is, in terms of what an idea makes possible. I have suggested above that such a choice is also axiological—that is, one which is concerned with values of various kinds. In one sense this is the idea that different understandings imply particular values and that in choosing one over another we choose in these terms. This is the form of some of the arguments on which I have drawn. For von Foerster (1991), the epistemology of being part of the world allows us to participate in the world with others while Glanville (2004/2009) argues that the devices of cybernetics presuppose a variety of values that are commonly held to be desirable.

Any understanding can be advocated in terms of the values that it implies. For instance, the contrary position to that I have taken, realism, embodies the values of truth and objectivity. These are advocated by some but contrast with those of cybernetics which regards them as leading to conflict and to avoiding responsibility (von Foerster, 1991, p. 65; von Foerster & Poerksen, 2002, pp. 30-31). To advocate a position in terms of the particular values it implies does not necessarily entail that the contrary position (here, realism) is "wrong" but that a choice is to be made in terms of

which values we wish to act out. Such a choice between incommensurable or conflicting values is familiar from my above discussions. Is this then a matter of an undecidable choice between one set of values and another? Rather than this, what I suggest is that when it comes to these sorts of choices (that is, those about how we understand our understanding), our decision can be guided not just by choosing between values but by choosing in terms of which choice better allows us to continue to choose in terms of values.[229] For this reason I advocate choosing to understand epistemology in terms of being part of the world (and so in terms of cybernetics and radical constructivism) as, especially when seen in relation to design, this does not just embody some particular values but also makes possible a way of acting in which I can consider questions of value implicitly in my action. The realism of being apart from the world, by contrast, obfuscates this possibility.[230] In this sense, I see the epistemology of cybernetics and design as implicitly ethical not in the sense of embodying values (and so being implicitly "ethically good") but in the sense that it involves ethical questions. In comparison, the certainty provided by realism (whether in the sense of understanding epistemology in terms of a correspondence with the real world; ethics in terms of moral codes, deontological rules or consequentialist calculations; or design in terms of its systemisation or optimisation) obstructs us from thinking ethically. It prevents us taking responsibility for our own reasoning and tends to terminate the possibility of a continuing dialogue with others. In response to this, the case I make for choosing to understand ourselves as being part of the world is not to assert responsibility and participatory dialogue as values over other possible choices but, rather, to understand these as prerequisites for choosing and acting in terms of values. That is, it is only where we do not justify ourselves with reference to some authoritative answer that we leave room for ourselves to consider ethics as part of our acting.

---

[229] This is a hybrid between an instrumental and axiological way of advocating a choice.

[230] This is what I understand as significant in von Foerster's (1991) own explanation of his choice to adopt the position of being part of the world as being because it "establishes a prerequisite for a foundation of ethics" (p. 66).

Reference list

Alexander, C. (1964). *Notes on the synthesis of form*. Cambridge, MA: Harvard University Press.

Alexander, C. (1971). The state of the art in design methods. *DMG newsletter, 5*(3), 3-7.

Amhoff, T. (2011, February). *No room for imagination: Building specifications in mid 19th century England*. Paper presented at Further Reading Required: Building specifications, contracts and technical literature, The Bartlett School of Architecture, UCL, London, UK.

Amhoff, T. (2012). "Except where herein otherwise directed": Building with legal documents in early nineteenth-century England. *ARQ: Architectural Research Quarterly, 16*(3), 238-244. doi: 10.1017/S1359135513000080

Anscombe, G. E. M. (1958). Modern moral philosophy. *Philosophy, 33*(124), 1-19. doi: 10.1017/S0031819100037943

Aragon, L. (1994). *Paris peasant* (S. W. Taylor, Trans.). Boston: Exact Change. (Original work published: 1926).

Archer, B. (1979). Design as a discipline. *Design Studies, 1*(1), 17-20. doi: 10.1016/0142-694X(79)90023-1

Archer, B. (2012). The nature of research. In S. Grand & W. Jonas (Eds.), *Mapping design research* (pp. 109-121). Basel: Birkhäuser. (Reprinted from: *Co-Design Journal*, January 1995, 6-13).

Ashby, W. R. (1964). *An introduction to cybernetics*. London: Methuen. (Original work published: 1956).

Ashby, W. R. (1991). General systems theory as a new discipline. In G. J. Klir (Ed.), *Facets of systems science* (pp. 249-257). New york, NY: Plenum Press. (Reprinted from: *General Systems Yearbook*, *3*(1), 1-6, 1958).

Asimov, I. (1968). *I, robot*. St. Albans: Panther Books. (Original work published: 1950).

Barnes, G. (2002). *Psychopathology of psychotherapy: A cybernetic study of theory*. PhD Thesis. RMIT University, Melbourne.

Barnes, G. (2007). Education in mind. In R. Glanville & K. H. Müller (Eds.), *Gordon Pask, philosopher mechanic: An introduction to the cybernetician's cybernetician* (pp. 65-96). Vienna: Edition Echoraum.

Barthes, R. (1967). The death of the author. *Aspen, 5/6*. Retrieved from http://www.ubu.com/aspen/aspen5and6/threeEssays.html

Bateson, G. (1985). *Mind and nature: A necessay unity*. London: Flamingo. (Original work published: 1979).

Bateson, G. (2000). *Steps to an ecology of mind*. Chicago, IL: University of Chicago Press. (Original work published: 1972).

Baudrillard, J. (2005). *The system of objects* (J. Benedict, Trans.). London: Verso. (Original work published: 1968).

Beesley, P. (2007). *Kinetic architectures and geotextile installations*. Toronto: Riverside Architectural Press.

Bentham, J. (1891). *A fragment on government*. Oxford: Clarendon Press. Retrieved from http://archive.org/details/afragmentongover00bentuoft (Original work published: 1776).

Berlin, I. (1998). "From hope and fear set free". In H. Hardy & R. Hausheer (Eds.), *The proper study of mankind: An anthology of essays* (pp. 91-118). London: Pimlico. (Reprinted from: *Proceedings of the Aristelian Society*, 64, 1964).

Berlin, I. (1998). The pursuit of the ideal. In H. Hardy & R. Hausheer (Eds.), *The proper study of mankind: An anthology of essays* (pp. 1-16). London: Pimlico. (Reprinted from: *New York Review of Books*, 17 March 1988).

Berlin, I. (1998). Two concepts of liberty. In H. Hardy & R. Hausheer (Eds.), *The proper study of mankind: An anthology of essays* (pp. 191-242). London: Pimlico. (Reprinted from: *Two concepts of liberty: An inaugural lecture delivered before the university of Oxford on 31 October 1958*, by I. Berlin, 1958, Oxford: Clarendon Press).

Berlin, I. (2000). *Three critics of the enlightenment: Vico, Hamann, Herder*. London: Pimlico.

Borges, J. L. (1998). On exactitude in science (A. Hurley, Trans.). In *Collected fictions* (p. 325). New York, NY: Penguin. (Original work published: 1946).

Bradley, S., & Pevsner, N. (2002). *London: The city churches*. New Haven, CT: Yale University Press. (Original work published: 1998).

Broadbent, G., & Ward, A. (1969). *Design methods in architecture*. London: Lund Humphries.

Bröcker, M. (2003). Between the lines: The part-of-the-world-position of Heinz von Foerster. *Cybernetics and Human Knowing, 10*(3/4), 51-65.

Buchanan, R. (1992). Wicked problems in design thinking. *Design Issues, 8*(2), 5-21. doi: 10.2307/1511637

Buckminster Fuller, R. (2008). *Operating manual for spaceship earth*. Baden: Lars Müller Publishers. (Original work published: 1969).

Burroughs, W. (1968). *The soft machine* (3rd ed.). London: Calder and Boyars. (Original work published: 1961).

Campbell, L., & Garnett, W. (1882). *The life of James Clerk Maxwell*. London: Macmillan. Retrieved from http://www.sonnetsoftware.com/bio/maxbio.pdf

Carroll, L. (2001). *Alice's Adventures in Wonderland*. London: Bloomsbury. (Original work published: 1865).

Chard, N. (2005). *Drawing indeterminate architecture, indeterminate drawings of architecture*. Vienna: Springer-Verlag.

Chow, R., & Jonas, W. (2009, July). *Beyond dualisms in methodology: An integrative design research medium "MAPS" and some reflections*. Paper presented at Undisciplined! Design Research Society Conference 2008, Sheffield Hallam University, Sheffield, UK. Paper retrieved from http://shura.shu.ac.uk/id/eprint/477

Churchman, C. W. (1967). Wicked problems [Guest editorial]. *Management Science, 14*(4), B-141-B-142. Retrieved from http://www.jstor.org/stable/2628678

Clair, J., & Szeemann, H. (Eds.). (1975). *The bachelor machines*. New York, NY: Rizzoli.

Clements, C. (Ed.). (2006). *Pataphysica 3: Some machines of pataphysics*. Athens, GA: mNemonic.

Conklin, J. (2006). *Dialogue mapping: Building shared understanding of wicked problems*. Chichester: Wiley.

Cox, G. (2006). *Sartre: A guide for the perplexed*. London: Continuum.

Coyne, R. (2011). *Derrida for architects*. London: Routledge.

Crane, T. (2003). *The mechanical mind: A philosophical introduction to minds, machines and mental representation* (2nd ed.). New York, NY: Routledge. (Original work published: 1995).

Cross, N. (1982). Designerly ways of knowing. *Design Studies, 3*(4), 221-227. doi: 10.1016/0142-694X(82)90040-0

Cross, N. (2001). Designerly ways of knowing: Design discipline versus design science. *Design Issues, 17*(3), 49-55. Retrieved from http://www.jstor.org/stable/1511801

Cross, N. (2007a). *Designerly ways of knowing*. Basel: Birkhäuser.

Cross, N. (2007b). From a design science to a design discipline: Understanding designerly ways of knowing and thinking. In R. Michel (Ed.), *Design research now: Essays and selected projects*. Basel: Birkhäuser.

Cross, N., Naughton, J., & Walker, D. (1981). Design method and scientific method. *Design Studies, 2*(4), 195-201. doi: 10.1016/0142-694X(81)90050-8

D'Anjou, P. (2011). An ethics of freedom for architectural design practice. *Journal of Architectural Education, 64*(2), 141-148. doi: 10.1111/j.1531-314X.2010.01137.x

Davenport, J. J., & Rudd, A. (Eds.). (2001). *Kierkegaard after MacIntyre: Essays on freedom, narrative, and virtue*. Chicago, IL: Open Court.

Derrida, J. (1986). Point de folie—Maintenant l'architecture: Bernard Tschumi: La case vide—La Villette, 1985. *AA Files, 12*, 65-75. Retrieved from http://www.jstor.org/stable/29543519

Derrida, J. (2004). *Dissemination* (B. Johnson, Trans.). London: Continuum. (Original work published: 1972).

Derrida, J. (2008). *The gift of death and literature in secret* (D. Wills, Trans., 2nd ed.). Chicago, IL: University of Chicago Press. (Original work published: 1992).

Dewey, J. (1905). The postulate of immediate empiricism. *The Journal of Philosophy, Psychology and Scientific Methods, 2*(15), 393-399. doi: 10.2307/2011400

Dorst, K., & Cross, N. (2001). Creativity in the design process: Co-evolution of problem-solution. *Design Studies, 22*(5), 425-437. doi: 10.1016/S0142-694X(01)00009-6

Dostoyevsky, F. (1993). *Notes from Underground* (R. Pevear & L. Volokhonsky, Trans.). London: Vintage Books. (Original work published: 1864).

Dreyfus, H. L. (1979). *What computers can't do: The limits of artificial intelligence* (Revised ed.). New York, NY: Harper and Row. (Original work published: 1972).

Dreyfus, H. L. (1991). *Being-in-the-world: A commentary on Heidegger's being and time, division 1*. Cambridge, MA: MIT Press.

Dubberly, H., & Pangaro, P. (2007). Cybernetics and service-craft: Language for behavior-focused design. *Kybernetes, 36*(9/10), 1301-1317. doi: 10.1108/03684920710827319

Dubberly, H., & Pangaro, P. (2009). On modelling: What is conversation, and how can we design for it? *Interactions Magazine, 16*(4), 22-28. doi: 10.1145/1551986.1551991

Eagleton, T. (2003). *Sweet violence: The idea of the tragic*. Malden, MA: Blackwell.

Eagleton, T. (2007). *The meaning of life*. Oxford: Oxford University Press.

Eisenman, P. (2000). Post-functionalism. In K. M. Hays (Ed.), *Architecture theory since 1968* (pp. 236-239). Cambridge, MA: MIT Press. (Reprinted from: *Oppositions*, *6*, 1976).

Eisenman, P. (2008). *Ten canonical buildings 1950-2000*. New York, NY: Rizzoli.

Evans, R. (1985). Not to be used for wrapping purposes: Peter Eisenman: Fin d'Ou T Hou S. *AA Files, 10*, 68-78. Retrieved from http://www.jstor.org/stable/29543477

Evans, R. (1986). Translations from drawing to building. *AA Files, 12*, 3-18. Retrieved from http://www.jstor.org/stable/29543512

Fletcher, J. F. (1966). *Situation ethics: The new morality*. London: SCM Press.

Foot, P. (1997). Virtues and vices. In R. Crisp & M. Slote (Eds.), *Virtue ethics* (pp. 163-177). Oxford: Oxford University Press. (Reprinted from: *Virtues and vices and other essays in moral philosophy*, by P. Foot, 1978, Berkeley, CA: University of California Press).

Forrester, J. W. (1971). *World dynamics*. Cambridge, MA: Wright-Allen Press.

Fox, W. (2006). *A theory of general ethics: Human relationships, nature, and the built environment*. Cambridge, MA: MIT Press.

Frampton, K. (1983). Towards a critical regionalism: Six points for an architecture of resistance. In H. Foster (Ed.), *The anti-aesthetic: Essays on postmodern culture* (pp. 16-30). Port Townsend, WA: Bay Press.

Frankl, V. E. (1984). *Man's search for meaning*. New York, NY: Pocket Books. (Original work published: 1946).

Frayling, C. (1993). Research in art and design. *Royal College of Art Research Papers, 1*(1).

Frazer, J. (1995). *An evolutionary architecture*. London: Architectural Association. Retrieved from http://www.aaschool.ac.uk/publications/ea/intro.html

Friedman, K. (2002). Theory construction in design research: Criteria, approaches, and methods. In D. Durling & J. Shackleton (Eds.), *Common ground: Proceedings of the Design Research Society international conference, Brunel University, September 5-7, 2002.* (pp. 388-414). Stoke-on-Trent, UK: Staffordshire University Press. Retrieved from http://www.academia.edu/3842323/Friedman_2002_Theory_Construction_in_Design_Research

Gadamer, H.-G. (1989). *Truth and method* (J. Weinsheimer & D. G. Marshall, Trans., 2nd ed.). London: Bloomsbury. (Original work published: 1975).

Gage, S. (2006). The wonder of trivial machines. *Systems Research and Behavioral Science, 23*(6), 771-778. doi: 10.1002/sres.763

Gage, S. (2007a). The boat/helmsman. *Technoetic Arts: A Journal of Speculative Research, 5*(1), 15-24. doi: 10.1386/tear.5.1.15_1

Gage, S. (2007b). Constructing the user. *Systems Research and Behavioral Science, 24*(3), 313-322. doi: 10.1002/sres.789

Gage, S. (2007c). How to design a black and white box. *Kybernetes, 36*(9/10), 1329-1339. doi: 10.1108/03684920710827337

Garrison, J. (1997). An alternative to von Glasersfeld's subjectivism in science education: Deweyan social constructivism. *Science & Education, 6*(6), 543-554. doi: 10.1023/a:1008645503209

Gedenryd, H. (1998). How designers work: Making sense of authentic cognitive activities. *Lund University Cognitive Studies, 75*. Retrieved from http://lup.lub.lu.se/record/18828/file/1484253.pdf

Giedion, S. (1969). *Mechanization takes command: A contribution to an anonymous history*. New York, NY: Norton. (Original work published: 1948).

Giedion, S. (1982). *Space, time and architecture: The growth of a new tradition* (5th, revised and enlarged ed.). Cambridge, MA: Havard University Press. (Original work published: 1941).

Gillispie, C. C. (1958). Lamarck and Darwin in the history of science. *American Scientist, 46*(4), 388-409. Retrieved from http://www.jstor.org/stable/27827201

Glanville, R. (1975). *A cybernetic development of epistemology and observation, applied to objects in space and time, as seen in architecture: Also known as the object of objects, the point of points—Or something about things.* PhD Thesis, Brunel University, London.

Glanville, R. (1981). Why design research? In R. Jacues & J. Powell (Eds.), *Design, science, method: Proceedings of the 1980 Design Research Society conference* (pp. 86-94). Guildford: Westbury House.

Glanville, R. (1982). Inside every white box there are two black boxes trying to get out. *Behavioral Science, 27*(1), 1-11. doi: 10.1002/bs.3830270102

Glanville, R. (1993). Pask: A slight primer. *Systems Research, 10*(3), 213-218. doi: 10.1002/sres.3850100326

Glanville, R. (1996). Communication without coding: Cybernetics, meaning and language (how language, becoming a system, betrays itself). *MLN, 111*(3), 441-462. Retrieved from http://www.jstor.org/stable/3251022

Glanville, R. (1997). A ship without a rudder. In R. Glanville & G. de Zeeuw (Eds.), *Problems of excavating cybernetics and systems*. Southsea: BKS+.

Glanville, R. (1999a). Living in lines. In R. McLeod (Ed.), *Interior cities*. Melbourne: RMIT Press.

Glanville, R. (1999b). Researching design and designing research. *Design Issues, 15*(2), 80-91. doi: 10.2307/1511844

Glanville, R. (2002a). Doing the right thing: The problems of…Gerard de Zeeuw, academic guerilla. *Systems Research and Behavioral Science, 19*(2), 107-113. doi: 10.1002/sres.451

Glanville, R. (2002b). Second order cybernetics. In F. Parra-Luna (Ed.), Systems science and cybernetics. In Encyclopaedia of life support systems (EOLSS). Oxford: EoLSS. Retrieved from http://www.eolss.net/

Glanville, R. (2004a). Appropriate theory. In J. Redmond, D. Durling & A. de Bono (Eds.), *Futureground: Proceedings of the Design Research Society international conference 2004*. Melbourne: Monash University.

Glanville, R. (2004b). The purpose of second-order cybernetics. *Kybernetes, 33*(9/10), 1379-1386. doi: 10.1108/03684920410556016

Glanville, R. (2005). Cybernetics. In C. Mitcham (Ed.), *Encyclopedia of science, technology, and ethics*. Woodbridge, CT: Macmillan.

Glanville, R. (2006a). Construction and design. *Constructivist Foundations, 1*(3), 103-110. Retrieved from http://www.univie.ac.at/constructivism/journal/1/3/103.glanville

Glanville, R. (2006b). Design and mentation: Piaget's constant objects. *The Radical Designist, 0*. Retrieved from http://www.iade.pt/designist/pdfs/000_05.pdf

Glanville, R. (2007a). An approach to cybernetics (Gordon Pask, 1961). In R. Glanville & K. H. Müller (Eds.), *Gordon Pask, philosopher mechanic: An introduction to the cybernetician's cybernetician* (pp. 13-27). Vienna: Edition Echoraum.

Glanville, R. (Ed.). (2007b). Cybernetics and design [Special double issue]. *Kybernetes, 36*(9/10).

Glanville, R. (2007c). Designing complexity. *Performance Improvement Quarterly, 20*(2), 75-96. doi: 10.1111/j.1937-8327.2007.tb00442.x

Glanville, R. (2007d). Gordon Pask (from the ISSS luminaries site). In R. Glanville & K. H. Müller (Eds.), *Gordon Pask, philosopher mechanic: An introduction to the cybernetician's cybernetician* (pp. 53-64). Vienna: Edition Echoraum.

Glanville, R. (2007e). Try again. Fail again. Fail better: The cybernetics in design and the design in cybernetics. *Kybernetes, 36*(9/10), 1173-1206. doi: 10.1108/03684920710827238

Glanville, R. (2009). A (cybernetic) musing: Ashby and the black box. In *The black boox, volume III: 39 steps* (pp. 365-373). Vienna: Edition Echoraum. (Reprinted from: *Cybernetics and Human Knowing*, *14*(2/3), 189-196, 2007).

Glanville, R. (2009a). A (cybernetic) musing: Black boxes. In *The black boox, volume III: 39 steps* (pp. 405-421). Vienna: Edition Echoraum. (Reprinted from: *Cybernetics and Human Knowing*, *16*(1/2), 153-167, 2009).

Glanville, R. (2009b). A (cybernetic) musing: Design and cybernetics. In *The black boox, volume III: 39 steps* (pp. 423-425). Vienna: Edition Echoraum. (Reprinted from: *Cybernetics and Human Knowing*, *16*(3/4), 175-186, 2009).

Glanville, R. (2009). A (cybernetic) musing: Desirable ethics. In *The black boox, volume III: 39 steps* (pp. 293-303). Vienna: Edition Echoraum. (Reprinted from: Cybernetics and Human Knowing, *11*(2), 77-88, 2004).

Glanville, R. (2010). *Freedom and the machine*. Inaugural Lecture. University College London, London. March 10, 2010.

Glanville, R. (2011). A (cybernetic) musing: Wicked problems. *Cybernetics and Human Knowing, 19*(1-2), 163-173. Retrieved from

http://www.chkjournal.org/administrator/components/com_webjournal/assets/columns/idPublication_519.pdf

Glanville, R. (2013). Radical constructivism = second order cybernetics. *Cybernetics and Human Knowing, 19*(4), 27-42. Retrieved from http://www.ingentaconnect.com/content/imp/chk/2012/00000019/00000004/art00003

Glanville, R., & Müller, K. H. (Eds.). (2007). *Gordon Pask, philosopher mechanic: An introduction to the cybernetician's cybernetician*. Vienna: Edition Echoraum.

Glanville, R., & Sweeting, B. (Eds.). (2011). Cybernetics: Art, design, mathematics—A meta-disciplinary conversation: Papers from the 2010 conference of the American Society for Cybernetics [Special double issue]. *Kybernetes, 40*(7/8).

Gödel, K. (2004). On formally undecidable propositions of principia mathematica and related systems. In M. Davis (Ed.), *The undecidable: Basic papers on undecidable propositions, unsolvable problems and computable functions* (pp. 4-38). Mineola, NY: Dover. (Original work published: 1931).

Goldschmidt, G. (1991). The dialectics of sketching. *Creativity Research Journal, 4*(2), 123-143. doi: 10.1080/10400419109534381

Goldschmidt, G. (1995). The designer as a team of one. *Design Studies, 16*(2), 189-209. doi: 10.1016/0142-694X(94)00009-3

Goodbun, J. (2011). Gregory Bateson's ecological aesthetics: An addendum to urban political ecology. *Field, 4*(1), 35-46. Retrieved from http://www.field-journal.org/uploads/file/2011%20Volume%204/field-journal_Ecology.pdf

Grand, S., & Jonas, W. (2012). *Mapping design research*. Basel: Birkhäuser.

Gropius, W., Taut, B., & Behne, A. (1970). New ideas on architecture (M. Bullock, Trans.). In U. Conrads (Ed.), *Programms and manifestoes on 20th century architecture* (pp. 46-48). Cambridge, MA: MIT Press. (Original work published: 1919).

Harman, G. (2002). *Tool-being: Heidegger and the metaphysics of objects*. Chicago, IL: Open Court.

Harman, G. (2007). *Heidegger explained: From phenomenon to thing*. Peru, IL: Open Court.

Harries, K. (1975). The ethical function of architecture. *Journal of Architectural Education, 29*(1), 14-15. doi: 10.2307/1424319

Harries, K. (1984). Space, place, and ethos: Reflection on the ethical function of architecture. *Artibus et Historiae, 5*(9), 159-165. doi: 10.2307/1483174

Harries, K. (1987). Philosophy and the task of architecture. *Journal of Architectural Education, 40*(2), 29-30. doi: 10.2307/1424928

Harries, K. (1997). *The ethical function of architecture*. Cambridge, MA: MIT Press.

Havik, K., Patteeuw, V., & Teerds, H. (Eds.). (2011). Productive uncertainty: Indeterminacy in spatial design, planning and management. *OASE, 85*.

Heidegger, M. (1962). *Being and time* (J. Macquarrie & E. Robinson, Trans.). Malden, MA: Blackwell. (Original work published: 1927).

Heidegger, M. (1971). "...Poetically man dwells..." (A. Hofstadter, Trans.). In *Poetry, language, thought* (pp. 211-229). New York, NY: Harper and Row. (Original work published: 1951).

Heidegger, M. (1971). The thing (A. Hofstadter, Trans.). In *Poetry, language, thought* (pp. 163-186). New York, NY: Harper and Row. (Original work published: 1950).

Heidegger, M. (1977). Building dwelling thinking (A. Hofstadter, Trans.). In D. F. Krell (Ed.), *Martin Heidegger: Basic writings from being and time (1927) to the task of thinking (1964)* (pp. 323-339). New York, NY: Harper and Row. (Original work published: 1951).

Heidegger, M. (1977). The end of philosophy and the task of thinking (J. Stambaugh, Trans.). In D. F. Krell (Ed.), *Martin Heidegger: Basic writings from being and time (1927) to the task of thinking (1964)* (pp. 373-392). New York, NY: Harper and Row. (Original work published: 1964).

Heidegger, M. (1977). The origin of the work of art (A. Hofstadter, Trans.). In D. F. Krell (Ed.), *Martin Heidegger: Basic writings from being and time (1927) to the task of thinking (1964)* (pp. 149-187). New York, NY: Harper and Row. (Original work published: 1935).

Heidegger, M. (1977). The question concerning technology (W. Lovitt, Trans.). In D. F. Krell (Ed.), *Martin Heidegger: Basic writings from being and time (1927) to the task of thinking (1964)* (pp. 287-317). New York, NY: Harper and Row. (Original work published: 1955).

Heidegger, M. (1999). *Contributions to philosophy (from enowning)* (P. Emad & K. Maly, Trans.). Bloomington, IN: Indiana University Press. (Original work published: 1989).

Henderson, L. D. (1998). *Duchamp in context: Science and technology in the Large Glass and related works*. Princeton: Princeton University Press.

Hill, L. (2007). *The Cambridge introduction to Jacques Derrida*. Cambridge, UK: Cambridge University Press.

Hofstadter, D. R. (1999). *Gödel, Escher, Bach: An eternal golden braid* (20th anniversary ed.). New York, NY: Basic Books. (Original work published: 1979).

Hughes, P., & Brecht, G. (1978). *Vicious circles and infinity: An anthology of paradoxes*. Hammondsworth: Penguin Books. (Original work published: 1975).

Hultén, K. G. P. (1968). *The machine: As seen at the end of the mechanical age*. New York, NY: Museum of Modern Art.

Husserl, E. (1970). *The crisis of European sciences and transcendental phenomenology: An introduction to phenomenological philosophy* (D. Carr, Trans.). Evanston: Northwestern University Press. (Original work published: 1936).

Husserl, E. (1998). *Ideas pertaining to a pure phenomenology and to a phenomenological philosophy—First book: General introduction to a pure phenomenology* (F. Kersten, Trans.). Dordrecht: Kluwer Academic. (Original work published: 1913).

Ioannidou, E. (2010). Humanist machines: Daniel Libeskind's Three Lessons in Architecture. In S. Bandyopadhyay, J. Lomholt, N. Temple & R. Tobe (Eds.), *The humanities in architectural design* (pp. 81-90). London: Routledge.

Jachna, T. (2011). Building(s), cybernetically. *Kybernetes, 40* (7/8), 1055-1065. doi: 10.1108/03684921111160296

James, W. (1904). A world of pure experience. *The Journal of Philosophy, Psychology and Scientific Methods, 1*(20), 533-543. doi: 10.2307/2011912

Jarry, A. (2006). Exploits and opinions of Doctor Faustroll, pataphysician: A neo-scientific novel (A. Lykiard, S. Watson Taylor & P. Edwards, Trans.). In A. Brotchie & P. Edwards (Eds.), *Alfred Jarry: Three early novels: Collected works II* (pp. 118-218). London: Atlas Press.

Jencks, C. (1984). *The language of post-modern architecture* (4th revised enlarged ed.). London: Academy Editions. (Original work published: 1977).

Jonas, W. (2007a). Design research and its meaning to the methodological development of the discipline. In R. Michel (Ed.), *Design research now: Essays and selected projects* (pp. 187-206). Basel: Birkhäuser.

Jonas, W. (2007b). Research through DESIGN through research: A cybernetic model of designing design foundations. *Kybernetes, 36*(9/10), 1362-1380. doi: 10.1108/03684920710827355

Jonas, W. (2012). Exploring the swampy ground. In S. Grand & W. Jonas (Eds.), *Mapping design research* (pp. 11-41). Basel: Birkhäuser.

Jones, J. C. (1970). *Design Methods*. London: Wiley.

Jones, J. C. (1977). How my thoughts about design methods have changed during the years. *Design Methods and Theories, 11*(1), 48-62.

Jung, C. G. (1961). Seven sermons to the dead (H. G. Baynes, Trans.). In A. Jaffé (Ed.), *Memories, dreams, reflections* (pp. 378-390). New York, NY: Vintage. Retrieved from http://gnosis.org/library/7Sermons.htm (Original work published: 1916).

Kafka, F. (1961). In the penal settlement (W. Muir & E. Muir, Trans.). In *Metamorphosis and other stories* (pp. 167-199). Harmondsworth: Penguin. (Original work published: 1919).

Kant, I. (1898). On a supposed right to tell lies from benevolent motives (T. K. Abbot, Trans.). In *Kant's critique of practical reason and other works on the theory of ethics* (5th revised ed., pp. 361-365). London: Longmans, Green and Co. Retrieved from http://oll.libertyfund.org/title/360 (Original work published: 1797).

Kauffman, L. H. (2003). Eigenforms: Objects as tokens for eigenbehaviors. *Cybernetics and Human Knowing, 10*(3/4), 73-90. Retrieved from http://www.ingentaconnect.com/content/imp/chk/2003/00000010/F0020003/art00006

Kauffman, L. H. (2005). EigenForm. *Kybernetes, 34*(1/2), 129-150. doi: 10.1108/03684920510575780

Kauffman, L. H. (2009). Reflexivity and eigenform: The shape of process. *Constructivist Foundations, 4*(3), 121-137. Retrieved from http://www.univie.ac.at/constructivism/journal/4/3/121.kauffman

Kenniff, T.-B. (2011). Bakhtinian dialogism as framework for participant architectural research. In P. Plowright & B. Gamper (Eds.), *Considering research: Reflecting upon current themes in architectural research* (pp. 169-178). Detroit: Lawrence Technological University.

Kersting, H. J. (2005). The responsibility of the social worker: Ethical implications of theory and practice. *Kybernetes, 34*(3/4), 409-418. doi: 10.1108/03684920510581594

Kidder, P. (2013). *Gadamer for architects*. London: Routledge.

Kierkegaard, S. (1944a). *Either/ or: A fragment of life* (F. Swenson & M. Swenson, Trans., Vol. I). London: Oxford University Press. (Original work published: 1843).

Kierkegaard, S. (1944b). *Either/ or: A fragment of life* (W. Lowrie, Trans., Vol. II). London: Oxford University Press. (Original work published: 1843).

Kierkegaard, S. (1962). *Philosophical fragments: Or, a fragment of philosophy* (D. Swenson & H. V. Hong, Trans., 2nd ed.). Princeton, NJ: Princetown University Press. (Original work published: 1844).

Kierkegaard, S. (1967). *Stages on life's way* (W. Lowrie, Trans.). New York, NY: Schocken Books. (Original work published: 1845).

Kierkegaard, S. (1968). *Concluding unscientific postscript to the philosophical fragments* (D. F. Swenson & W. Lowrie, Trans.). Princeton, NJ: Princetown University Press. (Original work published: 1846).

Kierkegaard, S. (1985). *Fear and Trembling* (A. Hannay, Trans.). London: Penguin. (Original work published: 1843).

Kipnis, J., & Leeser, T. (Eds.). (1997). *Chora L works: Jacques Derrida and Peter Eisenman*. New York, NY: Monacelli Press.

Korzybski, A. (1933). A non-Aristotelian system and its necessity for rigour in mathematics and physics. In *Science and sanity* (pp. 747-761). New York, NY: Institute of General Semantics. (Original work published: 1931).

Kostof, S. (1995). *A history of architecture: Settings and rituals* (2nd ed.). Oxford: Oxford University Press. (Original work published: 1985).

Krauss, R. (1979). Grids. *October, 9*, 51-64. doi: 10.2307/778321

Krell, D. F. (Ed.). (1977). *Martin Heidegger: Basic writings from being and time (1927) to the task of thinking (1964)*. New York, NY: Harper and Row.

Krippendorff, K. (1989). On the essential contexts of artifacts or on the proposition that "design is making sense (of things)". *Design Issues, 5*(2), 9-39. doi: 10.2307/1511512

Krippendorff, K. (1996). A second-order cybernetics of otherness. *Systems Research, 13*(3), 311-328. doi: 10.1002/(SICI)1099-1735(199609)13:3<311::AID-SRES106>3.0.CO;2-O

Krippendorff, K. (2006). *The semantic turn: A new foundation for design*. Boca Raton: Taylor and Francis.

Krippendorff, K. (2007a). The cybernetics of design and the design of cybernetics. *Kybernetes, 36*(9/10), 1381-1392. doi: 10.1108/03684920710827364

Krippendorff, K. (2007b). Design research, an oxymoron? In R. Michel (Ed.), *Design research now: Essays and selected projects* (pp. 67-80). Basel: Birkhäuser.

Krueger, T. (2000). Architecture of extreme environments. *Architectural Design, 70*(2), 48-59.

Krueger, T. (2007). Design and prosthetic perception. *Kybernetes, 36*(9/10), 1393-1405. doi: 10.1108/03684920710827373

Lamarck, J. B. (1963). *Zoological philosophy: An exposition with regard to the natural history of animals* (H. Elliott, Trans.). New York, NY: Hafner. Retrieved from http://www.archive.org/details/zoologicalphilos00lama (Original work published: 1809).

Lawson, B. R. (1979). Cognitive strategies in architectural design. *Ergonomics, 22*(1), 59-68. doi: 10.1080/00140137908924589

Le Corbusier. (1987). *The decorative art of today* (J. Dunnett, Trans.). Cambridge, MA: MIT Press. (Original work published: 1925).

Le Corbusier. (1989). *Towards a new architecture* (F. Etchells, Trans.). Oxford: Architectural Press. (Original work published: 1923).

Leach, N. (1998). The dark side of the domus. *The Journal of Architecture, 3*(1), 31-42. doi: 10.1080/136023698374297

Leach, N. (2005). Less aesthetics, more ethics. In N. Ray (Ed.), *Architecture and its ethical dilemmas* (pp. 135-142). London: Taylor and Francis.

Lettvin, J. Y., Maturana, H. R., McCulloch, W. S., & Pitts, W. H. (1959). What the frog's eye tells the frog's brain. *Proceedings of the IRE, 47*(11), 1940-1951. doi: 10.1109/jrproc.1959.287207

Libeskind, D. (1981). *Between zero and infinity: Selected projects in architecture*. New York, NY: Rizzoli.

Libeskind, D. (1985). *Theatrum mundi: Through the green membranes of space*. London: Architectural Association.

Livingston, P. (2010). Derrida and formal logic: Formalising the undecidable. *Derrida Today, 3*(2), 221-239. doi: 10.3366/drt.2010.0205

Louden, R. B. (1997). On some vices of virtue ethics. In R. Crisp & M. Slote (Eds.), *Virtue ethics* (pp. 201-216). Oxford: Oxford University Press. (Reprinted from: *American Philosophical Quarterly*, *21*(3), 227-236, 1984).

Lovejoy, A. O. (1936). *The great chain of being: A study of the history of an idea*. Cambridge, MA: Harvard University Press.

Lovelock, J. E. (1972). Gaia as seen through the atmosphere. *Atmospheric Environment, 6*(8), 579-580. doi: 10.1016/0004-6981(72)90076-5

MacIntyre, A. (1966). *A short history of ethics*. London: Routledge and Kegan Paul.

MacIntyre, A. (1967). Existentialism. In P. Edwards (Ed.), *The Encyclopedia of Philosophy* (Vol. III, pp. 147-154). New York, NY: Macmillan.

MacIntyre, A. (1985). *After virtue: A study in moral theory* (2nd corrected ed.). London: Duckworth. (Original work published: 1981).

MacIntyre, A. (1988). *Whose justice? Which rationality?* London: Duckworth.

Malpas, J. (2008). *Heidegger's topology: Being, place, world*. Cambridge, MA: MIT Press. (Original work published: 2006).

Manolopoulou, Y. (2006). Drawing on chance: Extracts from drafting pier 40. *The Journal of Architecture, 11*(3), 303-314. doi: 10.1080/13602360600931441

Manolopoulou, Y. (2011). The practice of chance. *OASE, 85*, 44-56.

Martínez-Delgado, A. (2002). Radical constructivism: Between realism and solipsism. *Science Education, 86*(6), 840-855. doi: 10.1002/sce.10005

Maturana, H. R. (1995). Neurophysiology of cognition. In H. von Foerster (Ed.), *Cybernetics of cybernetics: Or the control of control and the communication of communication* (2nd ed., pp. 112-122). Minneapolis, MN: Future Systems.

Maturana, H. R., & Varela, F. J. (1987). *The tree of knowledge: The biological roots of human understanding*. Boston, MA: Shambhala.

Mau, B. (2011). Incomplete manifesto for growth. Retrieved from Bruce Mau Design website: http://www.brucemaudesign.com/4817/112450/work/incomplete-manifesto-for-growth

Maxwell, J. C. (1871). *Theory of heat*. London: Longmans, Green and Co. Retrieved from http://books.google.co.uk/books?id=DqAAAAAAMAAJ

McCarter (Ed.). (1987). *Building; machines, Pamphlet architecture no. 12*. New York, NY: Princeton Architectural Press.

McLaren, P. (1999). *Schooling as a ritual performance: Toward a political economy of educational symbols and gestures* (3rd ed.). Lanham, MD: Rowman and Littlefield. (Original work published: 1986).

Mead, M. (1968). The cybernetics of cybernetics. In H. von Foerster, J. D. White, L. J. Peterson & J. K. Russell (Eds.), *Purposive Systems* (pp. 1-11). New York, NY: Spartan Books.

Medawar, P. (1986). *The limits of science*. Oxford: Oxford University Press. (Original work published: 1984).

Merleau-Ponty, M. (1962). *Phenomenology of Perception* (C. Smith, Trans.). London: Routledge and Kegan Paul. (Original work published: 1945).

Michel, R. (2007). *Design research now: Essays and selected projects*. Basel: Birkhäuser.

Mitchell, A. J. (2010). The fourfold. In B. W. Davis (Ed.), *Martin Heidegger: Key concepts* (pp. 208–218). Durham: Acumen.

Morris, W. (1995). *News from nowhere: Or, an epoch of rest, being some chapters from a utopian romance*. Cambridge, UK: Cambridge University Press. (Original work published: 1890).

Müller, A., & Müller, K. H. (Eds.). (2007). *An unfinished revolution? Heinz von Foerster and the Biological Computer Laboratory (BCL), 1958-1976*. Vienna: Edition Echoraum.

Müller, K. H. (2008). *The new science of cybernetics: The evolution of living research designs* (Vol. I: Methodology). Vienna: Edition Echoraum.

Müller, K. H. (2011). *The new science of cybernetics: The evolution of living research designs* (Vol. II: Theory). Vienna: Edition Echoraum.

Nagel, E., & Newman, J. R. (2005). *Gödel's proof*. London: Routledge. (Original work published: 1958).

Negroponte, N. (1969a). Toward a theory of architecture machines. *Journal of Architectural Education, 23*(2), 9-12. doi: 10.2307/1423828

Negroponte, N. (1969b). Towards a humanism through machines. *Architectural Design, 34*(9), 511-514.

Negroponte, N. (1970). *The architecture machine*. Cambridge, MA: MIT Press.

Negroponte, N. (1975). *Soft architecture machines*. Cambridge, MA: MIT Press.

Nelson, H. G., & Stolterman, E. (2003). *The design way: Intentional change in an unpredictable world: Foundations and fundamentals of design competence*. Englewood, NJ: Educational Technology.

Norberg-Schulz, C. (1965). *Intentions in architecture*. Cambridge, MA: MIT Press.

Norberg-Schulz, C. (1971). *Existence, space and architecture*. London: Studio Vista.

Norberg-Schulz, C. (1975). *Meaning in Western architecture*. London: Studio Vista.

Norberg-Schulz, C. (1980). *Genius loci: Towards a phenomenology of architecture*. London: Academy Editions.

Norberg-Schulz, C. (1986). *Architecture: Meaning and place: Selected essays*. New York, NY: Rizzoli.

Ogborn, J. (1997). Constructivist metaphors of learning science. *Science & Education, 6*(1/2), 121-133. doi: 10.1023/a:1008642412858

Pangaro, P. (1993). Pask as dramaturg. *Systems Research, 10*(3), 135-142. doi: 10.1002/sres.3850100317

Pangaro, P. (2008). Instruction for design and designs for conversation. In R. Luppicini (Ed.), *Handbook of conversation design for instructional applications* (pp. 35-48). Hershey, PA: Information Science Reference.

Pask, G. (1961). *An approach to cybernetics*. London: Hutchinson.

Pask, G. (1969). The architectural relevance of cybernetics. *Architectural Design, 34*(9), 494-496.

Pask, G. (1970). The meaning of of cybernetics in the behavioual sciences (The cybernetics of behaviour and cognition; extending the meaning of "goal"). In J. Rose (Ed.), *The Progress of Cybernetics* (2nd ed., pp. 15-44). London: Gordon and Breach.

Pask, G. (1971). A comment, a case history and a plan. In J. Reichardt (Ed.), *Cybernetics, art and ideas* (pp. 76-99). London: Studio Vista.

Pask, G. (1972). A fresh look at cognition and the individual. *International Journal of Man-Machine Studies, 4*(3), 211-216. doi: 10.1016/S0020-7373(72)80002-6

Pask, G. (1975a). Artificial intelligence: A preface and a theory. In N. Negroponte (Ed.), *Soft architecture machines* (pp. 7-31). Cambridge, MA: MIT Press.

Pask, G. (1975b). *Conversation, cognition and learning: A cybernetic theory and methodology*. Amsterdam: Elsevier. Retrieved from http://pangaro.com/pask/Conversationcognitionandlearning.zip

Pask, G. (1975c). *The cybernetics of human learning and performance: A guide to theory and research*. London: Hutchinson. Retrieved from http://pangaro.com/pask/Cyberneticsofhumanlearningandperformance.zip

Pask, G. (1976). *Conversation theory: Applications in education and epistemology*. Amsterdam: Elsevier. Retrieved from http://pangaro.com/pask/ConversationTheory.zip

Pask, G. (1980). The limits of togetherness. In S. H. Lavington (Ed.), *Information processing* (pp. 999-1012). Amsterdam: North Holland Publishing Company.

Pask, G. (1988). Learning strategies, teaching strategies, and conceptual or learning style. In R. R. Schmeck (Ed.), *Learning strategies and learning styles* (pp. 83-100). New York, NY: Plenum Press.

Pask, G. (1996). Heinz von Foerster's self organization, the progenitor of conversation and interaction theories. *Systems Research, 13*(3), 349-362. doi: 10.1002/(sici)1099-1735(199609)13:3<349::aid-sres103>3.0.co;2-g

Pask, G., Kallikourdis, D., & Scott, B. (1975). The representation of knowables. *International Journal of Man-Machine Studies, 7*(1), 15-134. doi: 10.1016/S0020-7373(75)80003-4

Pask, G., & Scott, B. (1973). Caste: A system for exhibiting learning strategies and regulating uncertainties. *International Journal of Man-Machine Studies, 5*(1), 17-52. doi: 10.1016/S0020-7373(73)80008-2

Pask, G., Scott, B., & Kallikourdis, D. (1973). A theory of conversations and individuals (exemplified by the learning process on CASTE). *International Journal of Man-Machine Studies, 5*(4), 443-566. doi: 10.1016/S0020-7373(73)80002-1

Paz, O. (1990). *Marcel Duchamp: Appearance stripped bare* (R. Phillips & D. Gardner, Trans.). New York, NY: Arcade Publishing. (Original work published: 1968).

Pearce, M., & Spiller, N. (Eds.). (1995). Architects in cyberspace. *Architectural Design, 65*(11/12).

Peirce, C. S. (1901). Index (in exact logic). In J. M. Baldwin (Ed.), *Dictionary of philosophy and psychology* (Vol. I). New York, NY: MacMillan. Retrieved from http://psychclassics.yorku.ca/Baldwin/Dictionary/defs/I2defs.htm#Indexi

Peirce, C. S. (1992). On a new list of categories. In N. Houser & C. Kloesel (Eds.), *The essential Peirce: Selected philosophical writings* (Vol. I, pp. 1-10). Bloomington, IN: Indiana University Press. Retrieved from http://www.cspeirce.com/menu/library/bycsp/newlist/nl-frame.htm (Reprinted from: *Proceedings of the American Academy of Arts and Sciences*, 7, 287-298, 1868).

Peirce, C. S. (1998). What is a sign? In Pierce Edition Project (Ed.), *The essential Peirce: Selected philosophical writings* (Vol. II, pp. 4-10). Bloomington, IN: Indiana University Press.

Retrieved from http://www.iupui.edu/~peirce/ep/ep2/ep2book/ch02/ep2ch2.htm (Original work published: 1894).

Perec, G. (2010). *An attempt at exhausting a place in Paris* (M. Lowenthal, Trans.). Cambridge, MA: Wakefield Press. (Original work published: 1975).

Pevsner, N. (1990). *An outline of European architecture* (7th ed.). London: Penguin Books. (Original work published: 1943).

Piaget, J. (1955). *The child's construction of reality* (M. Cook, Trans.). London: Routledge and Kegan Paul

Piaget, J., & Inhelder, B. (1956). *The child's conception of space* (F. J. Langdon & J. L. Lunzer, Trans.). New York, NY: Norton.

Pickering, A. (2010). *The cybernetic brain: Sketches of another future*. Chicago, IL: University of Chicago Press.

Popper, K. R. (1963). *Conjectures and refutations: The growth of scientific knowledge*. London: Routledge and Kegan Paul.

Price, C. (Ed.). (1984). *The square book*. Chichester: Wiley.

Pugin, A. W. N. (1836). *Contrasts: Or, a parallel between the noble edifices of the fourteenth and fifteenth centuries and similar buildings of the present day; shewing the present decay of taste.* Salisbury: Author. Retrieved from http://books.google.co.uk/books?id=vKRWAAAAMAAJ

Quale, A. (2007). Radical constructivism, and the sin of relativism. *Science & Education, 16*(3-5), 231-266. doi: 10.1007/s11191-006-9038-6

Radford, A. (2009). Responsive cohesion as the foundational value in architecture. *The Journal of Architecture, 14*(4), 511-532. doi: 10.1080/13602360903119553

Raunig, G. (2010). *A thousand machines: A concise philosophy of the machine as social movement* (A. Derieg, Trans.). Los Angeles, CA: Semiotext(e).

Rawes, P. (2007). Second-order cybernetics, architectural drawing and monadic thinking. *Kybernetes, 36*(9/10), 1486-1496. doi: 10.1108/03684920710827436

Rawes, P. (Ed.). (2013). *Relational architectural ecologies: Architecture, nature and subjectivity*. London: Routledge.

Ray, N. (2005). *Architecture and its ethical dilemmas*. London: Taylor and Francis.

Reichardt, J. (Ed.). (1968). Cybernetic serendipity: The computer and the arts [Special issue]. *Studio International*. Retrieved from http://cyberneticserendipity.com/cybernetic_serendipity.pdf

Reichardt, J. (1971). *Cybernetics, art and ideas*. London: Studio Vista.

Richardson, W. J. (2003). *Heidegger: Through phenomenology to thought* (4th ed.). New York, NY: Fordham University Press. (Original work published: 1963).

Rittel, H. (1972). On the planning crisis: Systems analysis of the "first and second generations". *Bedriftskonomen, 8*, 390-396.

Rittel, H., & Webber, M. (1973). Dilemmas in a general theory of planning. *Policy Sciences, 4*, 155-169.

Rosenblueth, A., & Wiener, N. (1950). Purposeful and non-purposeful behavior. *Philosophy of Science, 17*(4), 318-326. Retrieved from http://www.jstor.org/stable/185931

Rosenblueth, A., Wiener, N., & Bigelow, J. (1943). Behavior, purpose and teleology. *Philosophy of Science, 10*(1), 18-24. Retrieved from http://www.jstor.org/stable/184878

Rudofsky, B. (1964). *Architecture without architects: A short introduction to non-pedigreed architecture*. New York, NY: Museum of Modern Art.

Sandes, C. A. (2008). St Alphage's tower, Cripplegate: Monument to tenacity, the story of the survival of a City landmark. *London Archaeologist, 12*(2), 231-235.

Sartre, J.-P. (1948). *Existentialism and humanism* (P. Mairet, Trans.). London: Metheun. (Original work published: 1946).

Sartre, J.-P. (1969). *Being and nothingness: An essay on phenomenological ontology* (H. E. Barnes, Trans.). London: Methuen. (Original work published: 1943).

Schön, D. A. (1991). *The reflective practitioner: How professionals think in action*. Farnham: Arena. (Original work published: 1983).

Schumacher, P. (2008, September). *Parametricism as style: Parametricist manifesto*. Paper presented at The Dark Side Club, 11th Architecture Biennale, Venice, Italy. Paper retrieved from http://www.patrikschumacher.com/Texts/Parametricism%20as%20Style.htm

Scott, B. (1993). Working with Gordon: Developing and applying conversation theory (1968-1978). *Systems Research, 10*(3), 167-182. doi: 10.1002/sres.3850100321

Scott, B. (2001). Gordon Pask's conversation theory: A domain independent constructivist model of human knowing. *Foundations of Science, 6*(4), 343-360. doi: 10.1023/A:1011667022540

Scott, B. (2004). Second-order cybernetics: An historical introduction. *Kybernetes, 33*(9/10), 1365-1378. doi: 10.1108/03684920410556007

Scott, B. (2007). The cybernetics of Gordon Pask. In R. Glanville & K. H. Müller (Eds.), *Gordon Pask, philosopher mechanic: An introduction to the cybernetician's cybernetician* (pp. 29-52). Vienna: Edition Echoraum.

Scott, B. (2011). *Explorations in second-order cybernetics: Reflections on cybernetics, psychology and education*. Vienna: Edition Echoraum.

Sharr, A. (2007). *Heidegger for architects*. London: Routledge.

Shepheard, P. (2003). *Artificial love: A story of machines and architecture*. Cambridge, MA: MIT Press.

Simon, H. A. (1996). *The sciences of the artificial* (3rd ed.). Cambridge, MA: MIT Press. Retrieved from http://m.friendfeed-media.com/092e5a73c91e0838eeb11e0fe90edaf9e9afc065 (Original work published: 1969).

Smith, T. P. (2004). The late medieval bricks and brickwork of London wall in Saint Alphage Garden, EC2. *London Archaeologist, 10*(10), 255-262.

Spade, P. V. (1996). Jean-Paul Sartre's being and nothingness [Class notes]. Retrieved from http://pvspade.com/Sartre/pdf/sartre1.pdf

Spector, T. (2001). *The ethical architect*. New York, NY: Princetown Architectural Press.

Spencer Brown, G. (1973). *Laws of form*. Toronto: Bantam Books. (Original work published: 1969).

Spiller, N. (Ed.). (1998a). Architects in cyberspace II. *Architectural design, 68*(11/12).

Spiller, N. (1998b). *Digital dreams: Architecture and the new alchemic technologies*. London: Ellipsis.

Spiller, N. (Ed.). (2002). *Cyber_reader: Critical writings for the digital era*. London: Phaidon Press.

Spiller, N. (2005). Deformography: The poetics of cybridised architecture. *Papers of surrealism, 4*. Retrieved from http://www.surrealismcentre.ac.uk/papersofsurrealism/journal4/index.htm

Spiller, N. (2006). *Visionary architecture: Blueprints of the modern imagination*. London: Thames and Hudson.

Steenson, M. W. (2010). Cedric Price's Generator. *Crit (the journal of the American Institute of Architecture Students), 69*. Retrieved from http://www.girlwonder.com/blog/wp-content/uploads/2010/04/crit-piece.pdf

Stewart, D. J. (2000). An essay on the origins of cybernetics. [Originally part of PhD thesis, University of Bristol, Bristol, 1959]. Retrieved from http://www.hfr.org.uk/cybernetics-pages/origins.htm

Suchting, W. A. (1992). Constructivism deconstructed. *Science & Education, 1*(3), 223-254. doi: 10.1007/bf00430275

Sweeting, B. (2007). Deciding an undecidable architecture. *Haecceity Papers, 2*(2).

Sweeting, B. (2009). Communication in design, communication in architecture: A project for an allotment calendar. In J. Verbeke & A. Jakimowicz (Eds.), *Communicating (by) design: Proceedings of the colloquium "Communicating (by) design" at Sint-Lucas Brussels from 15th-17th April 2009* (pp. 539-543). Brussels: Chalmers University of Technology and School of Architecture Sint-Lucas.

Sweeting, B. (2011a). Conversing with drawings and buildings: From abstract to actual in architecture. *Kybernetes, 40* (7/8), 1159-1165. doi: 10.1108/03684921111160386

Sweeting, B. (Ed.). (2011b). *Invisible machines*. Retrieved from http://eprints.brighton.ac.uk/8792/1/Invisible_Machines_Digital_Edition.pdf [Limited edition exhibition catalogue, assembled and vacuum packed at the Redundant Architects Recreation Association (RARA), London, 4 June 2011].

Sweeting, B. (2011c). Thinking thinking thinking. *P.E.A.R. (Paper for Emerging Architectural Research), 4*, 44-46.

Taylor, R. (1950a). Comments on a mechanistic conception of purposefulness. *Philosophy of Science, 17*(4), 310-317. Retrieved from http://www.jstor.org/stable/185930

Taylor, R. (1950b). Purposeful and non-purposeful behavior: A rejoinder. *Philosophy of Science, 17*(4), 327-332. Retrieved from http://www.jstor.org/stable/185932

Thyssen, O. (1992). Ethics as second order morality. *Cybernetics and Human Knowing, 1*(1), 31-47.

Till, J. (2005). The negotiation of hope. In P. Blundell Jones, D. Petrescu & J. Till (Eds.), *Architecture and participation* (pp. 23-41). London: Spon Press.

Till, J. (2007). Architecture and contingency. *Field, 1*(1), 120-135. Retrieved from http://www.field-journal.org/uploads/file/2007_Volume_1/j%20till.pdf

Till, J. (2009). *Architecture depends*. Cambridge, MA: MIT Press.

Tillich, P. (1956). *The new being*. London: SCM.

Varela, F. J., Maturana, H. R., & Uribe, R. (1974). Autopoiesis: The organization of living systems, its characterization and a model. *Biosystems, 5*(4), 187-196. doi: 10.1016/0303-2647(74)90031-8

Varela, F. J., Thompson, E., & Rosch, E. (1991). *The embodied mind: Cognitive science and human experience*. Cambridge, MA: MIT Press.

Vesely, D. (1985). Architecture and the conlfict of representation. *AA Files, 8*, 21-38. Retrieved from http://www.jstor.org/stable/29543434

Vesely, D. (2002). The architectonics of embodiment. In G. Dodds & R. Tavernor (Eds.), *Body and building: Essays on the changing relation of body and architecture* (pp. 28-43). Cambridge, MA: MIT Press.

Vesely, D. (2004). *Architecture in the age of divided representation: The question of creativity in the shadow of production*. Cambridge, MA: MIT Press.

Vesely, D. (2010, June). *The latent ground of the natural world: Introduction to the communicative role of architecture*. Paper presented at The Communicative Role of Architecture, Leicester School of Architecture, De Montfort University, Leicester, UK. Paper retrieved from http://www.dmu.ac.uk/Images/Dalibor%20Vesely%20Latent%20Ground%20final%20version_tcm6-62553.doc

Volpert, M. (2006). Dei ex Goldberg machina. In C. Clements (Ed.), *Pataphysica 3: Some machines of pataphysics* (pp. 83-102). Athens, GA: mNemonic.

von Foerster, H. (1991). Through the eyes of the other. In F. Steier (Ed.), *Research and reflexivity* (pp. 63-75). London: Sage.

von Foerster, H. (1992). Ethics and second-order cybernetics. *Cybernetics and Human Knowing, 1*(1), 9-19. (Original work published: 1990).

von Foerster, H. (1993). On Gordon Pask. *Systems Research, 10*(3), 35-42. doi: 10.1002/sres.3850100306

von Foerster, H. (Ed.). (1995). *Cybernetics of cybernetics: Or, the control of control and the communication of communication* (2nd ed.). Minneapolis, MN: Future Systems. (Original work published: 1974).

von Foerster, H. (2003). Cybernetics of cybernetics. In *Understanding understanding: Essays on cybernetics and cognition* (pp. 283-286). New York, NY: Springer-Verlag. (Reprinted from: *Communication and contol*, pp. 5-8, by K. Krippendorff, Ed., 1979, New York, NY: Gordon and Breach).

von Foerster, H. (2003). Cybernetics of epistemology. In *Understanding understanding: Essays on cybernetics and cognition* (pp. 229-246). New York, NY: Springer-Verlag. (Original work published: 1974).

von Foerster, H. (2003). Ethics and second-order cybernetics. In *Understanding understanding: Essays on cybernetics and cognition* (pp. 287-304). New York, NY: Springer-Verlag. (Original work published: 1990).

von Foerster, H. (2003). Objects: Tokens for (eigen-)behaviors. In *Understanding understanding: Essays on cybernetics and cognition* (pp. 261-272). New York, NY: Springer-Verlag. (Original work published: 1976).

von Foerster, H. (2003). On constructing a reality. In *Understanding understanding: Essays on cybernetics and cognition* (pp. 211-228). New York, NY: Springer-Verlag. (Reprinted from: *Environmental design research*, volume II, pp. 35-46, by F. E. Preiser, Ed., 1973, Stroudberg: Dowden, Hutchinson and Ross).

von Foerster, H. (2003). Responsibilities of competence. In *Understanding understanding: Essays on cybernetics and cognition* (pp. 191-197). New York, NY: Springer-Verlag. (Reprinted from: *Journal of Cybernetics*, *2*(2), 1-6, 1972).

von Foerster, H. (2003). *Understanding understanding: Essays on cybernetics and cognition*. New York, NY: Springer-Verlag.

von Foerster, H., & Poerksen, B. (2002). *Understanding systems* (K. Leube, Trans.). New York, NY: Kluwer Academic.

von Glasersfeld, E. (1974). Piaget and the radical constructivist epistemology. In C. D. Smock & E. von Glasersfeld (Eds.), *Epistemology and education* (pp. 1-24). Athens, GA: Follow Through Publications.

von Glasersfeld, E. (1980). Viability and the concept of selection. *American Psychologist, 35*(11), 970-974. Retrieved from http://www.vonglasersfeld.com/060

von Glasersfeld, E. (1981). Declaration of the American Society for Cybernetics. *American Society of Cybernetics Newsletter*. Retrieved from http://www.vonglasersfeld.com/065 [Note: I have given page references to the version archived at http://www.univie.ac.at/constructivism/EvG/ which differ from the original publication].

von Glasersfeld, E. (1982). An Interpretation of Piaget's constructivism. *Revue Internationale de Philosophie, 36*(4), 612-635. Retrieved from http://www.vonglasersfeld.com/077

von Glasersfeld, E. (1984). An introduction to radical constructivism. In P. Watzlawick (Ed.), *The invented reality* (pp. 17-40). New York, NY: Norton. Retrieved from http://www.vonglasersfeld.com/070.1 [Note: I have given page references to the version

archived at http://www.univie.ac.at/constructivism/EvG/ which differ from the original publication].

von Glasersfeld, E. (1985). Reconstructing the concept of knowledge. *Archives de Psychologie, 53*, 91-101.

von Glasersfeld, E. (1989a). Cognition, construction of knowledge, and teaching. *Synthese, 80*(1), 121-140. Retrieved from http://www.vonglasersfeld.com/118

von Glasersfeld, E. (1989b). Constructivism in education. In T. Husen & T. N. Postlethwaite (Eds.), *The international encyclopedia of education, supplementary volume I* (pp. 162-163). Oxford: Pergamon Press. Retrieved from http://www.vonglasersfeld.com/114

von Glasersfeld, E. (1990a). An exposition of constructivism: Why some like it radical. *Journal for Research in Mathematics Education Monograph, 4*, 19-29. doi: 10.2307/749910

von Glasersfeld, E. (1990b). Teleology and the concepts of causation. *Philosophica 46*(2), 17-43. Retrieved from http://logica.ugent.be/philosophica/fulltexts/46-2.pdf

von Glasersfeld, E. (1991). Knowing without metaphysics: Aspects of the radical constructivist position. In F. Steier (Ed.), *Research and reflexivity* (pp. 12-29). London: Sage.

von Glasersfeld, E. (1992). Why I consider myself a cybernetician. *Cybernetics and Human Knowing, 1*(1), 21-25.

von Glasersfeld, E. (1995). *Radical constructivism: A way of knowing and learning*. London: Routledge Falmer.

von Glasersfeld, E. (1996). Farewell to objectivity. *Systems Research, 13*(3), 279-286. doi: 10.1002/(SICI)1099-1735(199609)13:3<279::AID-SRES91>3.0.CO;2-L

von Glasersfeld, E. (2000). Problems of constructivism. In L. P. Steffe & P. W. Thompson (Eds.), *Radical constructivism in action—Building on the pioneering work of Ernst von Glasersfeld* (pp. 1-9). London: Routledge Falmer. Retrieved from http://www.vonglasersfeld.com/233

von Glasersfeld, E. (2007). Aspects of constructivism. Vico, Berkeley, Piaget. In *Key works in radical constructivism* (pp. 91-99). Rotterdam: Sense.

von Glasersfeld, E. (2009). Relativism, fascism, and the question of ethics in constructivism. *Constructivist Foundations, 4*(3), 117-120. Retrieved from http://www.univie.ac.at/constructivism/journal/4/3/117.glasersfeld

von Glasersfeld, E., & Cobb, P. (1983). Knowledge as environmental fit. *Man-Environment Systems, 13*(5), 216-224. Retrieved from http://www.vonglasersfeld.com/084

von Glasersfeld, E., & Varela, F. (1985). Problems of knowledge and cognizing organisms. *Aprendizagem/ Desenvolvimento, 2*(6), 17-23. Retrieved from http://www.vonglasersfeld.com/089

Waters, C. (1999). Invitation to dance—A conversation with Heinz von Foerster. *Cybernetics and Human Knowing, 6*(4), 81-84.

Webster, H. (2004). Facilitating critically reflective learning: Excavating the role of the design tutor in architectural education. *Art, Design & Communication in Higher Education, 2*(3), 101-111.

Webster, H. (2008). Architectural education after Schön: Cracks, blurs, boundaries and beyond. *Journal for Education in the Built Environment, 3*(2), 63-74.

Weinberg, G. M. (1991). The simplification of science and the science of simplification. In G. J. Klir (Ed.), *Facets of systems science*. New York, NY: Plenum Press. (Reprinted from: *Trends in general systems theory*, by G. J. Klir, Ed., 1972, New York, NY: Wiley.).

Wertheim, M. (1999). *The pearly gates of cyberspace: A history of space from Dante to the internet*. London: Norton.

Westman, A. (1987). The church of St. Alphege. *Archaeology Today, 8*(11), 17-22.

Whitehead, A. N., & Russell, B. (1997). *Principia mathematica to *56* (2nd, abridged ed.). Cambridge, UK: Cambridge University Press. (Original work published: 1910).

Wiener, N. (1958). My connection with cybernetics: Its origin and its future. *Cybernetica, 1*(1), 1-14. Retrieved from http://www.nickgreen.pwp.blueyonder.co.uk/Wiener1958ConCyb.pdf

Wiener, N. (1961). *Cybernetics: Or, control and communication in the animal and the machine* (2nd ed.). Cambridge, MA: MIT Press. (Original work published: 1948).

Wittgenstein, L. (1974). *Tractatus logico-philosophicus* (D. F. Pears & B. F. McGuinness, Trans.). London: Routledge and Kegan Paul. (Original work published: 1921).

Wittgenstein, L. (2009). *Philosophical investigations* (G. E. M. Anscombe, P. M. S. Hacker & J. Schulte, Trans., 4th ed.). Chichester: Wiley. (Original work published: 1953).

Yates, F. A. (1969). *The theatre of the world*. London: Routledge and Kegan Paul.

Yates, F. A. (1984). *The art of memory*. London: Ark. (Original work published: 1966).

Young, J. (2006). The fourfold. In C. B. Guignon (Ed.), *The Cambridge companion to Heidegger* (2nd ed., pp. 373-392). Cambridge, UK: Cambridge University Press.